Owner's Pictorial Guide

For The Care and Understanding Of

The Mills Bell Slot Machine

FOR ALL ESCALATOR MODELS AND MOST GOOSENECK MODELS MANUFACTURED AFTER 1920

APPENDICES INCLUDED FOR BONUS AND FUTURITY MODELS AND OTHER SPECIAL FEATURES

Robert N. Geddes - Daniel R. Mead

William Collis
Norfolk, Va.
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Owner's Pictorial Guide
for the
Care and Understanding
of the
Mills Bell Slot Machine

THIRD EDITION

WRITTEN BY

Robert N. Geddes

ILLUSTRATED AND EDITED BY

Daniel R. Mead

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FOREWORD

Back in August 1979 when this *Owner's Pictorial Guide for the Care and Understanding of the Mills Bell Slot Machine* was first published there was a tremendous void in antique slot machine literature. Very little material was available to assist collectors in maintaining and repairing their own slot machines.

We at Mead Publishing Company have been committed to filling this void for over 15 years. Since the original release of this, our first book in the now highly popular *Owner's Pictorial Guide* series, our philosophy has remained the same: provide the reader with a complete background in theory and operation of the given machine rather than offering a limited symptom-fix trouble-shooting guide.

The reason for this approach is two-fold: first, covering all the possible combinations of mechanical malfunctions in a single guide would be virtually impossible; second, an owner who has a thorough understanding of his machine will be able to diagnose and correct nearly *any* problem he encounters without difficulty. In fact, it will also allow him to predict and correct minor problems before they become major.

The success of this approach has been overwhelming; the *Owner's Guides* have sold far more quickly than we had ever anticipated. Thousands upon thousands of readers have utilized our easy-to-follow directions and clearly referenced photographs to make themselves proficient in the repair and maintenance of their Mills machines.

The Mills bell slot machines were very popular in their day and are relatively numerous as antiques as well. Their popularity is due, in part, to their sturdy design and precision manufacturing. The particular "Hi-Top" model featured in this manual was selected because it provides a good representation of the most elaborate mechanisms and sophisticated features. The basic manual covers machines made from 1932 through 1971; earlier gooseneck models manufactured prior to 1932 and various special feature machines are covered in the appendices.

All procedures for repair and maintenance have been made easy to understand. By adhering to the manual's directions and using only a few simple tools, the entire slot machine can be disassembled, cleaned, lubricated and reassembled—even if the reader has never before seen the inside of a slot machine.

Our hope, however, is that our readers will gain more than just an understanding of how their machines work. We hope they will also gain a greater appreciation for how marvelous these collectibles really are. From the psychological factors which influenced reel strip design to the many options and gimmicks which attempted to disguise the true gambling nature of the devices, antique slot machines are unique, mysterious, beautiful relics of our country's past. With the knowledge and understanding that this book provides we anticipate that the reader will come away with a new level of respect for these wonderful and historic machines.

Daniel R. Mead, Publisher
Las Vegas, Nevada
February 1995

IMPORTANT

Register Your New Book

Thank you for purchasing your new *Owner's Pictorial Guide*. A number of changes, corrections and revisions have been incorporated into this edition. This book is intended to be a complete maintenance and service manual for your slot machine. A tremendous amount of time and painstaking care have been taken to make this well-illustrated, detailed instruction and maintenance manual as accurate and as easy to use as possible.

As a service to our customers, we at Mead Publishing Company would like to offer you an opportunity to keep informed of any modifications or updates made to this *Owner's Pictorial Guide*. It's so easy! Just turn to the inside back cover of the book, complete the registration card and mail it to us for customer support. This will enable us to notify you of any future corrections, additions, changes and enhancements. In addition, we will keep you abreast of other important developments which may be of interest to you.

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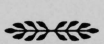

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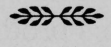

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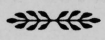


Loose Change Magazine

1 Introduction

Background Information

This book describes the overhaul, maintenance and theory of operation of the Mills bell slot machine. The engineering concept of the Mills three-reel machine began in 1909 with the Mills LIBERTY BELL. This basic design evolved through succeeding gooseneck versions, ending with the manufacture of the Mills JACKPOT bell (Poinsettia) in 1931. In 1932 Mills introduced their "silent" line of bell machines. This was the first radical design change they had presented in 22 years. The "silents" introduced the horizontal escalator which was to be incorporated in all later models of their machines up to the introduction of their electro-mechanical machines in the early 1960s.

The remarkable thing about the Mills bell machines made from 1932 onward was the fact that the mechanism was basically interchangeable between all models. The pre-1932 models (goosenecks) were even interchangeable with the later escalator models with simple modification. The gooseneck coin mechanism was removed and the coin detection levers were extended to reach the escalator. The Sega, which was manufactured in Japan and was built from actual machine drawings of the Mills bell slot machine, is completely compatible with all models of the Mills bell machines. The compatibility of the mechanism with the particular case in which it was placed was limited only by the particular version and model of the jackpot being used, the special features of the mechanism (gold coin or bonus awards) and payout compatibility. Payout compatibility is easily achieved by simply changing the payout card to correspond to the mechanism configuration.

The mechanisms themselves underwent some evolutionary design changes over the years due to the incorporation of anti-cheating devices. Certain parts of the machine, which received excessive wear, were physically strengthened, making the machine better and more reliable from an engineering design standpoint. These modifications, however, do not effect the basic compatibility between mechanisms. Thus, while this book is specifically concerned with the overhaul and maintenance of a specific Mills bell machine, its scope is general enough to include all Mills machines incorporating escalators whether or not they are of the gooseneck style. When significant variations exist between this machine and other versions or models of this machine, they are specifically noted, and examples of the other versions are addressed in appropriate appendices.

The theory of the operation of the Mills bell machine is basically the same for all models. The engineering design changes incorporated into the machine over the years, refined and molded it into a better performing machine while not effecting the theory of operation.

It is interesting to note when Mills eventually went to an electro-mechanical machine, the mechanical portion of the machine was basically the same Mills bell mechanism. The escalator was replaced with a coin accept mechanism, and the jackpot was replaced with a hopper which dispensed jackpots of varying amounts.

Book Organization

This book has been organized into chapters which deal with a particular component or aspect of the slot machine. Each component is explained in terms of its theory of operation, overhaul, maintenance and repair.

Chapter 2 covers the basic operation of the machine including its proper removal from the case, basic assembly functions, cycling of the mechanism in and out of the case, filling and emptying of coins and the use of the manually set levers and controls.

Chapters 3 through 8 cover the operating mechanism itself. Chapter 3 discusses the general theory of operation and explains how to remove the reels from the mechanism. Chapter 4 defines the parts and presents directions for proper lubrication. Chapter 5 describes how to clean the mechanism by removing the clock and the slides. Chapters 6 and 8 give a detailed step-by-step description of the complete disassembly and reassembly of the mechanism. Once the mechanism has been disassembled it is very helpful to "follow along" with Chapter 7 to learn the theory of operation before beginning the final assembly of the machine.

Chapter 7 presents the detailed theory of operation of the mechanism and is written to stand alone. In order to show certain views of various components of the machine, it was necessary to take apart and remove portions of the machine which would not normally be disassembled, but these photographs were felt to be necessary in order to thoroughly explain the detailed workings of the machine.

Chapter 7 should be used for learning how the machine operates but *not* for the assembly or disassembly of the machine which is thoroughly covered in Chapters 6 and 8.

Chapter 9 describes the theory and overhaul of the reel assembly. In addition, a straightforward set of directions is provided to compute the payout statistics of the reel assembly.

Chapters 10 through 13 cover the theory of operation and overhaul of the jackpot, escalator, handle, handle pump assembly and special award assemblies respectively.

Chapter 14 describes the adjustments that can be made to the machine. Each possible adjustment is considered separately and the technique for making it is discussed. Once the machine is understood, this chapter should provide useful information in ways to fix an "ailing" machine.

There are also several appendices at the back of this book which deal with less common features, such as skill stops, and the different design features of earlier models, such as the gooseneck style coin entry.

Nomenclature

This book has been used to standardize the nomenclature and to make it completely consistent with the nomenclature provided by other manufacturers in their descriptions of their machines and various parts; it is also consistent with other books in the *Owner's Pictorial Guide* series.

It is easier to describe the part by its proper name, such as the coin advance bar operating lever, rather than to describe a part as "that long, funny-looking lever sticking up on the right hand side of the machine which kinda hooks around and down — you know?" Correct terminology goes a long way in talking about the mechanism, especially over the telephone!

The terms *check, token, trade check* and *gaming token* are all interchangeable. Generally they are the size of a coin with a hole in the center to ease confusion. Since the machine choosen for this book accepts tokens and delivers a special token as a reward for achieving three "7's" across the payout line, parts of the machine dealing with the detection and acceptance of normal trade tokens as well as the trade tokens themselves will be referred to by the term *check*, while the components that make up the special award feature and its reward tokens will be referred to by the term *token.*

Essential vs. Non-essential Parts

The slot machine model used in this book was selected because it represented a complete machine with almost all of the features that Mills had incorporated in their advanced version of the bell machine. While a collector may wish to have his machine as "original" as possible, and therefore contain all of the gadgetry for home use, many of these features are unnecessary; and some are even undesirable and should be removed. Chapter 8 shows these features and how they may be modified or removed to prevent possible or potential trouble in the routine home operation of the machine.

Tools and Mechanical Ability

You don't have to be a mechanical genius to work on your slot machine. Just a few simple tools and a little patience should equip you with enough ability to analyze and repair 95% of the problems you may encounter with your machine.

Figure 1.1 shows an "ideal" tool kit for the complete overhaul of the slot machine. The only tools that are out of the ordinary are the two extra long screwdrivers (the larger one has a 12″ shaft, and the smaller one has a 10″ shaft with a screw-holding spring clip) and the ¼″ socket extension wrench which is required for the reel assembly overhaul. The home fashioned tool next to the socket wrench is simply a piece of heavy gauge wire which is used as a spring hook. Although not shown here, it is desireable to have a feeler gauge to determine proper clearances when installing the reel assembly.

The remaining tools consist of a medium 8″ screwdriver, a small 3″ screwdriver, a pair of needle nose pliers, a pair of utility slip-joint pliers, a pair of diagonal-cutting pliers, a 5″ adjustable wrench, a jar of assorted cotter pins, a tube of grease and a long-

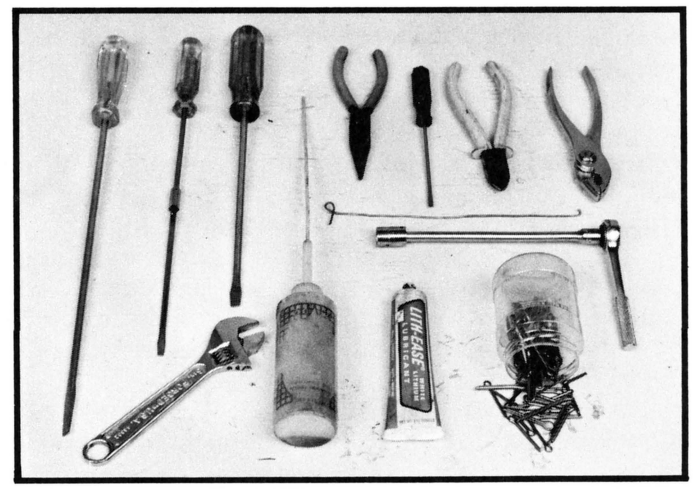


Figure 1.1

spout oiler with medium-weight machine oil (not motor oil). A fast evaporating machine cleaning solvent and a slightly more caustic cleaning solvent will also be necessary; this will be discussed further in Chapter 5.

2 General Operating Instructions

Mechanism Removal

Figure 2.1 illustrates the machine as viewed from the rear with the back door removed. In order to remove the mechanism from the case, the first step is to remove the back door by opening the Mills lock. It should be noted that the standard Mills key fits with either side up, however, only one of these two ways will enable the key to turn. In recent years the Mills locks have become collectors' items and are valuable in themselves. Consequently, many Mills machines will be found using newer and different lock/key sets.

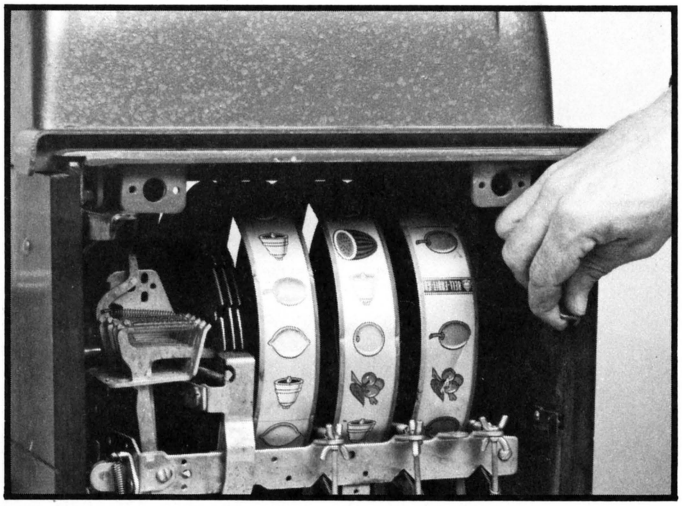


Figure 2.1

After the back door has been removed, the top rear section of the case, commonly referred to as the back top or bonnet, is removed by lifting the two catches on each side of the case as shown in Figure 2.1.

Next remove the two thumb screws, if they are present, which are located at the back right and left side of the mechanism base. In most instances these thumb screws will be missing because their presence makes it awkward to remove the mechansim; they are neither necessary nor desirable for home use. Lift the two side clamps up and off the mechanism base, as illustrated in Figure 2.2. These clamps, for both the top back and the base, have flat holding springs to keep them in an extended or up position and free from the

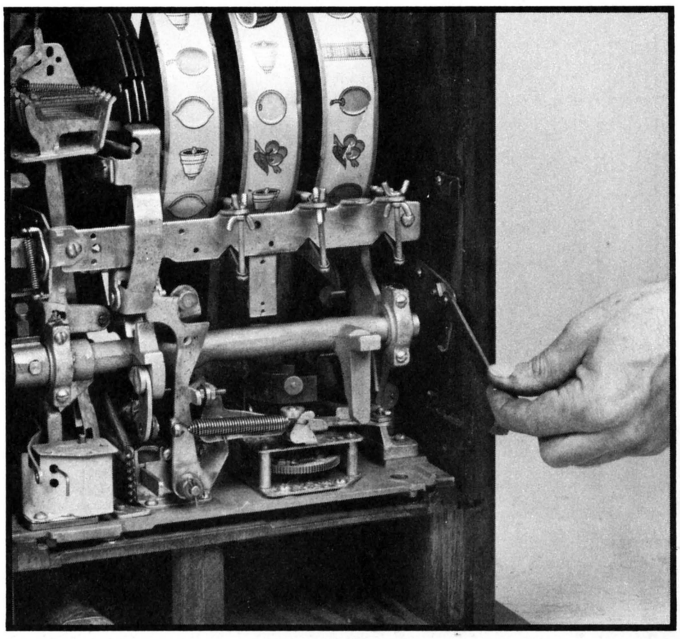


Figure 2.2

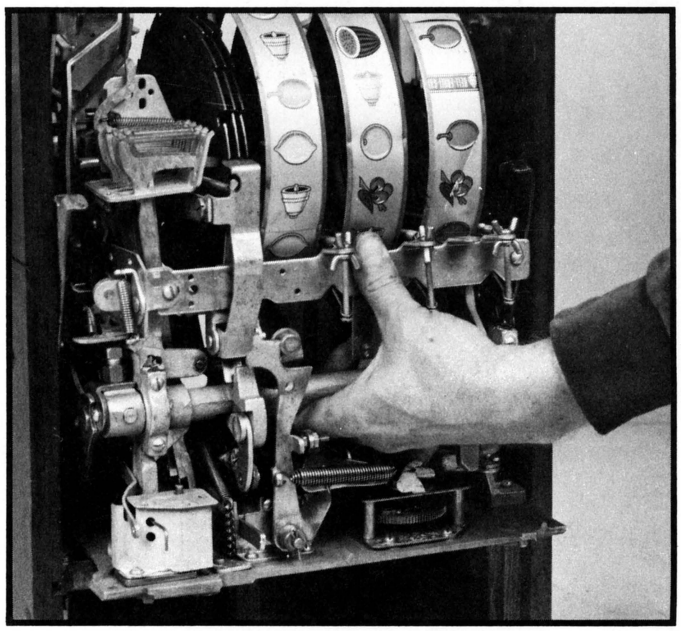


Figure 2.3

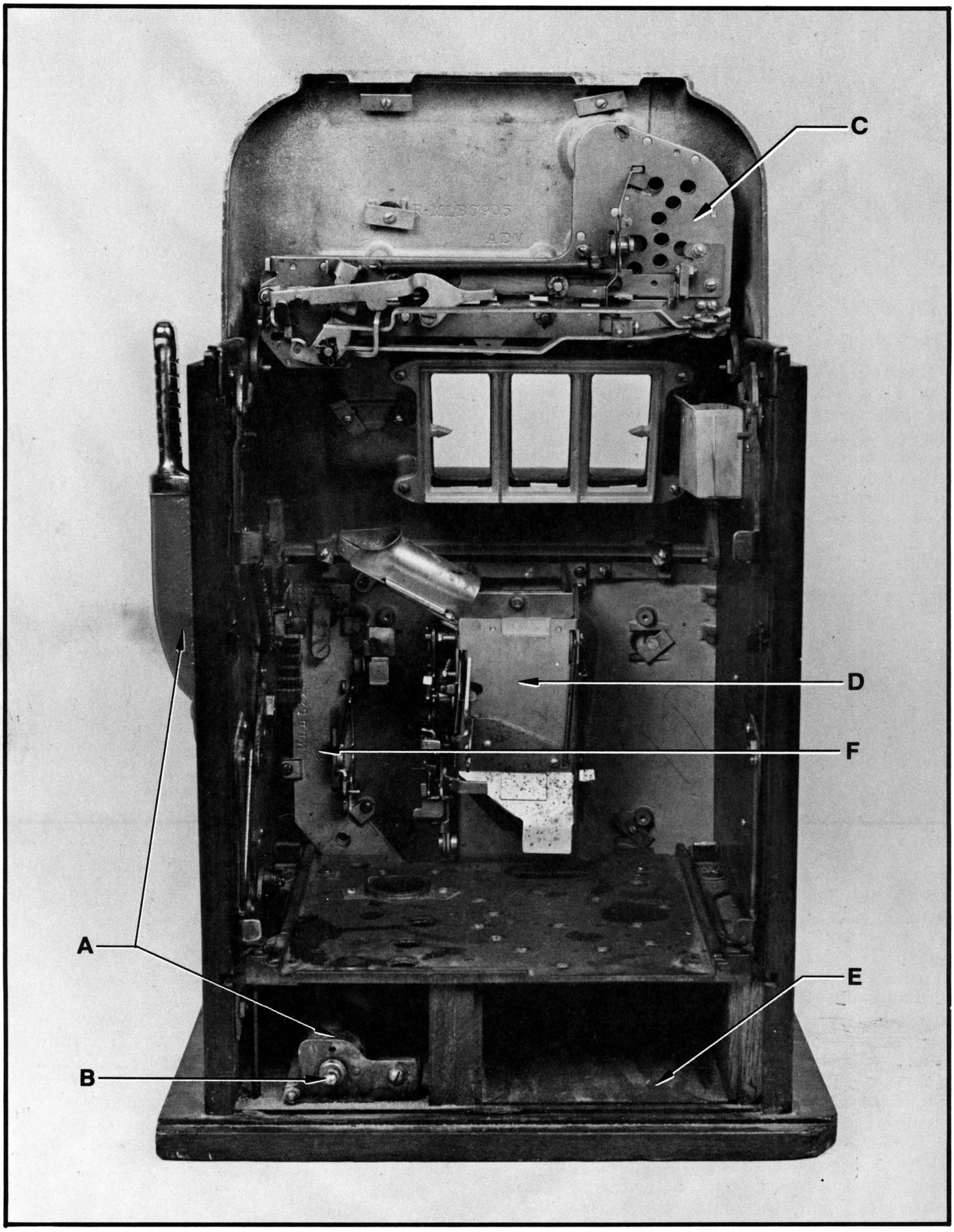


Figure 2.4

mechanism. Grasp the mechanism as shown in Figure 2.3 by the main operating fork and lifting up gently, pull the entire mechanism back and out of the case, supporting the front of the mechanism by the upper coin chute assembly.

Case Assemblies and Their Basic Functions

Figure 2.4 shows the case from the rear after the operating mechanism has been removed. There are four assemblies attached to the case which operate in conjunction with the removed mechanism. The succeeding paragraphs will describe each assembly and its major functions.

The handle and handle pump assembly is shown by Arrow A, on Figure 2.4. This assembly consists of the handle, the handle starting lever, the handle pump linkage, and the handle pump. If the handle is pulled down and released, it will raise itself back up in a dampened manner. The rate of return of this handle can be adjusted by the screw on the end of the pump unit itself, shown by Arrow B. It should be noted that if the handle is jerked too quickly in a forward direction, the dog on the handle starting lever will engage the ratchet and lock the handle preventing any additional forward motion.

The escalator, shown by Arrow C, runs across the top of the machine case and is responsible for the acceptance, rejection and manipulation of coins. Once a coin is inserted into the machine and is accepted by the escalator, the coin then travels in full view across the escalator for the next five plays. The reason for showing the coins is to prevent players from using slugs, since the coins that they are playing are easily viewed by the operator. As will be seen later, it is the coin detector lever assembly located on the escalator which signals the machine that there is a proper coin that has been played and the escalator is ready for sequencing.

The jackpot, shown by Arrow D, is located in the center of the front panel of the machine. This particular jackpot mechanism has both a main jackpot and a reserve jackpot. The function of the main jackpot is to release its contents when the jackpot has been obtained by alignment of the winning symbols on the payline. On the next play of the machine, the main (bottom) jackpot closes and the reserve (top) jackpot then falls down to partially fill the main jackpot; this presents a replenished jackpot to the player rather than one which is empty on succeeding plays. The placing of coins into the jackpot is automatically performed from the coins which are put into the machine; upon the filling of both the main and the reserve jackpot, the overflow coins then spill into the cashbox area in the bottom of the machine as shown by Arrow E.

The award token assembly, shown by Arrow F, is located behind the front panel of the case and to the left of the jackpot assembly. It is the function of this mechanism to release one token into the payout tray each time a special combination appears. On this particular machine the special combination for the award token is the appearance of three "7s" on the payline. It should be noted that this is a special feature included on this machine, and is not necessarily on all machines even though the front castings have provisions for its inclusion as an option.

Operation of the Mechanism Out of the Case

Figure 2.5 shows the operating mechanism removed from the case. A screwdriver has been placed over the main operating lever stud and under one of the operating lever posts. The screwdriver placed in this position simulates the arm of the slot machine in the cycling of the mechanism. To cycle the mecha-

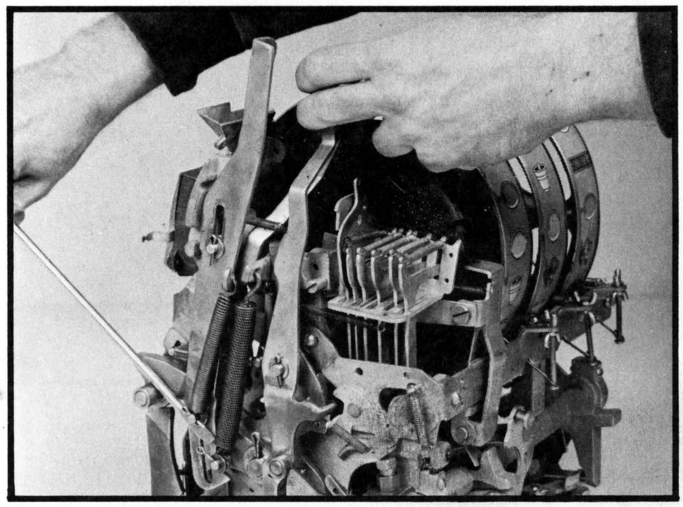


Figure 2.5

nism, press down on the handle of the screwdriver while simultaneously holding back the coin detector operating levers to inhibit them from traveling for-

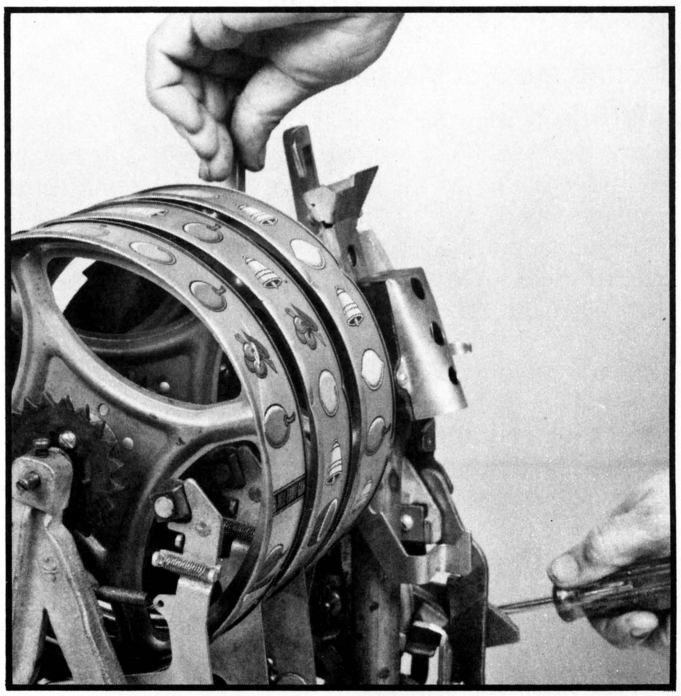


Figure 2.6

ward, as shown in Figure 2.6. Continue pressing down on the screwdriver until the reels begin spinning.

After the reels have begun spinning, the mechanism may or may not continue to complete its cycle depending upon the positioning of the fan stop lever assembly. On some mechanisms this part is missing, in which case the machine will continue to cycle. With mechanisms where the fan stop lever arm assembly is present, the fan stop lever arm needs to be pushed

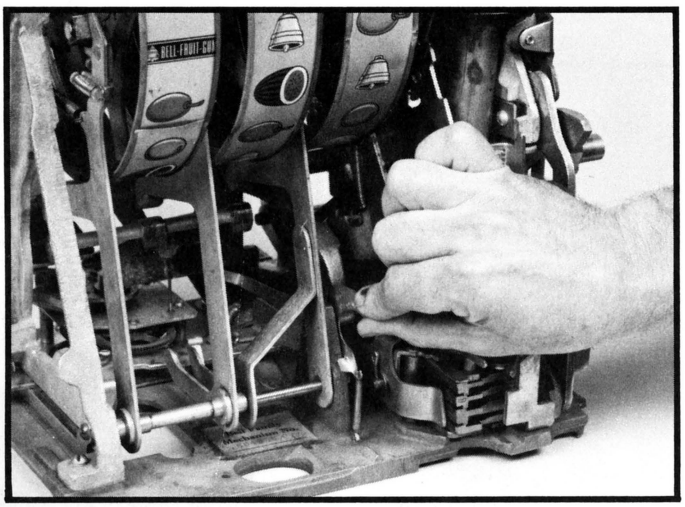


Figure 2.7

down and away from the clock fan. Figure 2.7 shows the fan stop lever being moved in order to allow the fan on the clock to turn, thereby allowing the mechanism to complete its cycle. It should be noted that if continued and repeated cycling is desired, the spring leading from the base of the mechanism to the fan stop lever can be easily disconnected allowing the fan stop lever to rest out of the way.

Setting the Slot Machine Reels

The reels may be manually positioned in order to allow any specific combination of fruit to appear on the payout line of the machine. If the mechanism is equipped with the fan stop lever, setting of the reels may be accomplished by manually rotating the first reel to the desired position and then releasing the fan stop lever until the first reel is locked and held in position by its reel stop lever as shown in Figure 2.7. Note that the payout line, as shown in Figure 2.7, represents two cherries and a bell, which are in line with the top of the coin tube coverplate. Next, set the second reel to the desired position and again release the fan stop lever in a similar manner until the reel stop lever holds that reel in position. The third reel is stopped in position similarly. Finally, allow the machine to complete its cycle by holding the fan stop lever down until the clock fan stops of its own accord.

If the machine does not have a fan stop lever, then the fan must be stopped manually by inserting the finger on the fan blade after the machine reels have begun to spin as shown in Figure 2.8. Each reel is then set to the desired position on the payout line and the fan blade released and allowed to run until each reel has been stopped by its reel stop lever. This method again proceeds from reel to reel until the position of all three reels have been assured, and then the fan is allowed to run to complete the machine cycle. A little practice is required with this method since the reels must be set from the front of the machine, as well as the pressing down on the screwdriver blade, while the fan blade must be stopped and controlled from behind the machine.

The second method presented here for stopping the fan and setting the three reels manually is also the same method which is used to set combinations in the window while the mechanism is in the case. When the mechanism is in the case, it is not necessary to use the screwdriver, instead a coin can be inserted into the machine and played with the handle while the finger is held on the fan as illustrated in Figure 2.8. The reels are then set such that the desired combination ap-

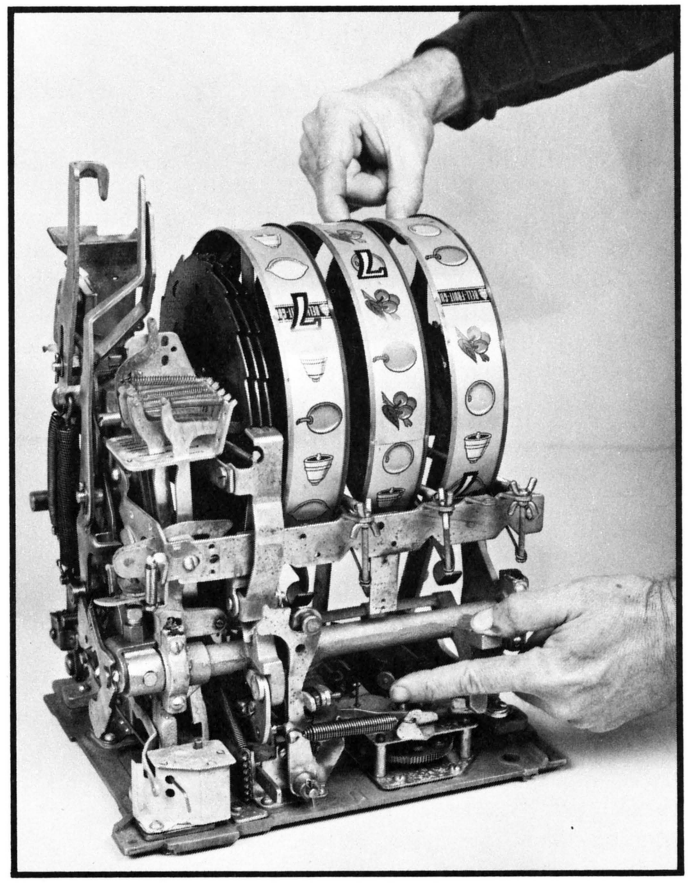


Figure 2.8

pears on the center line in the window, one at a time, while releasing the clock fan enough to allow each reel to come to a set position.

Cycling the Mechanism in the Case

Here is an important note. Attempting to cycle the

mechanism by holding back the detection levers shown in Figures 2.5 and 2.6 while the mechanism is in the case, can lead to a potential lock-up situation. If the escalator in the case is a complete escalator, then it will cause lock-up if the mechanism is attempted to be cycled without a coin. If the escalator has had its coin advance holding lever removed, then replay can be accomplished by holding back the detection levers. If it is desired to cycle the mechanism while in the case with a complete escalator and no coin, then not only do the coin detection levers need

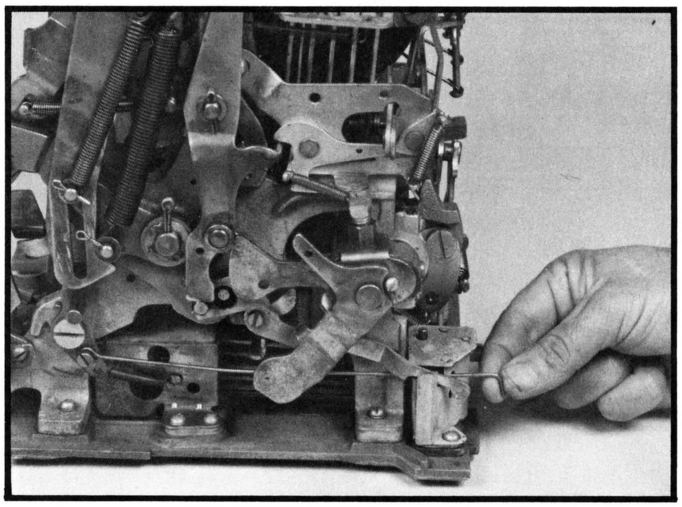


Figure 2.9

to be held back while pulling the handle down, but the operating lever stop release wire shown in Figure 2.9 must also be pressed in at the same time. Needless to say, this is a cumbersome process and is not recommended.

Manual Machine Levers

The operating lever stop release wire shown in Figure 2.9 can be used when cycling the machine without a coin to prevent lock-up. Its main function is to release the operating lever stop, for whatever reason may have caused the operating stop lever to lock the main operating lever, and allow the mechanism to complete its cycle so it can be easily removed from the case; in many instances of jamming, the escalator will lock-up with the mechanism, thus making removal of the mechanism extremely difficult. Normally the lock-up can be remedied by shaking the handle and attempting to push the operating lever stop release wire forward into the mechanism such that the machine can complete its cycle.

Figure 2.10 shows the setting of the anti-check payout lever. The lever has two positions: toward the front of the mechanism and toward the rear of the mechanism. The positon of the lever as shown in Figure 2.10 is toward the rear of the mechanism and this is the normal operating position for this lever. This lever may be moved to its forward position which inhibits the payout of coins from the machine regardless

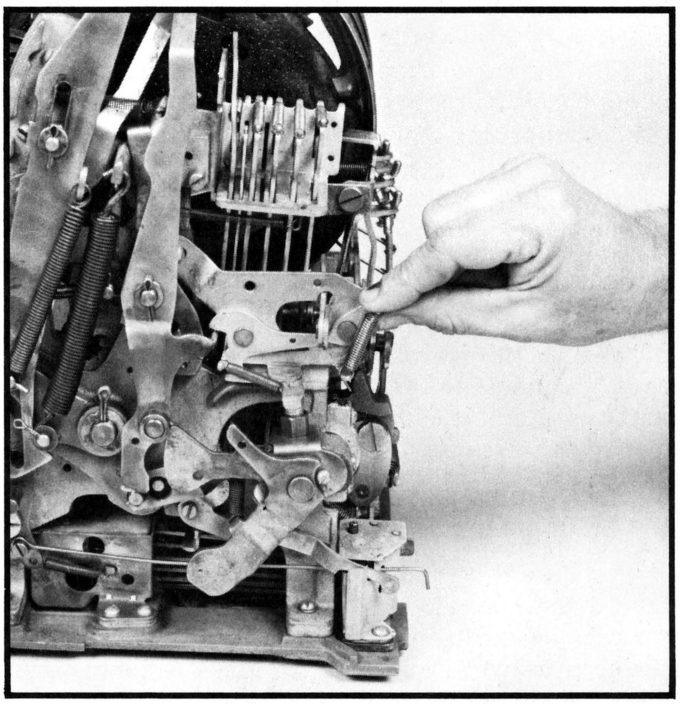


Figure 2.10

of winning combinations. In instances where the symptom of the machine malfunction is that it does not pay off, the trouble can often be traced to the wrong positioning of this lever. Thus, it is very important to make certain this lever is kept in the backward positon. The basic purpose of this part is to allow the

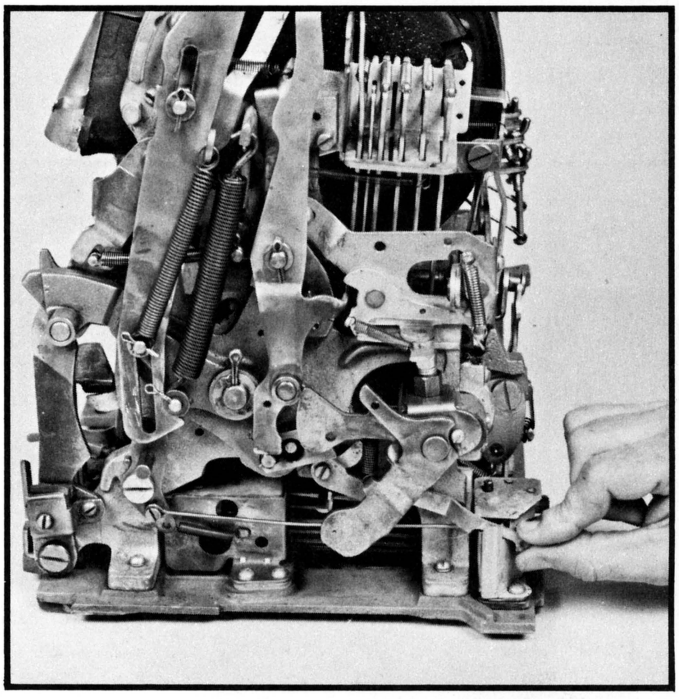


Figure 2.11

option of inhibiting payout when tokens are being played.

Figure 2.11 shows the manual positioning of the coin tube loading arm. The normal position for this

lever is in the full down position. When the machine is cycled with this lever in the upward position, the reels and the timing mechanism become bypassed and inoperative. When the machine is in the case and the coin tube loading arm is in the up position, then playing a coin in the machine allows the escalator to be cycled, but the machine will cause no motion of the reels or of its timing mechanism. The function of this arm is to load coins into the machine in a rapid manner without cycling the mechanism and without removing the mechanism from the case. As a matter of practice, this is a very inefficient way to accomplish these functions, and for normal home use this lever is never used; if it is left in the wrong position, however, it may be the cause of trouble and malfunction.

Loading Coins and Special Award Tokens into the Machine

There are three places in this machine where coins (and tokens) need to be loaded: namely, the coin tube, the jackpot and the special award token chute. The tokens are loaded in the award token assembly with the machine out of the case. The tokens are inserted into the award token assembly (see Figure 2.4, Arrow F), moving the award token stop lever out of the way and placing five tokens into the coin chute and then replacing the award token stop lever to the full vertical position. This award token stop lever serves the purpose of preventing the tokens from being shaken out of the coin chute by tipping the machine over.

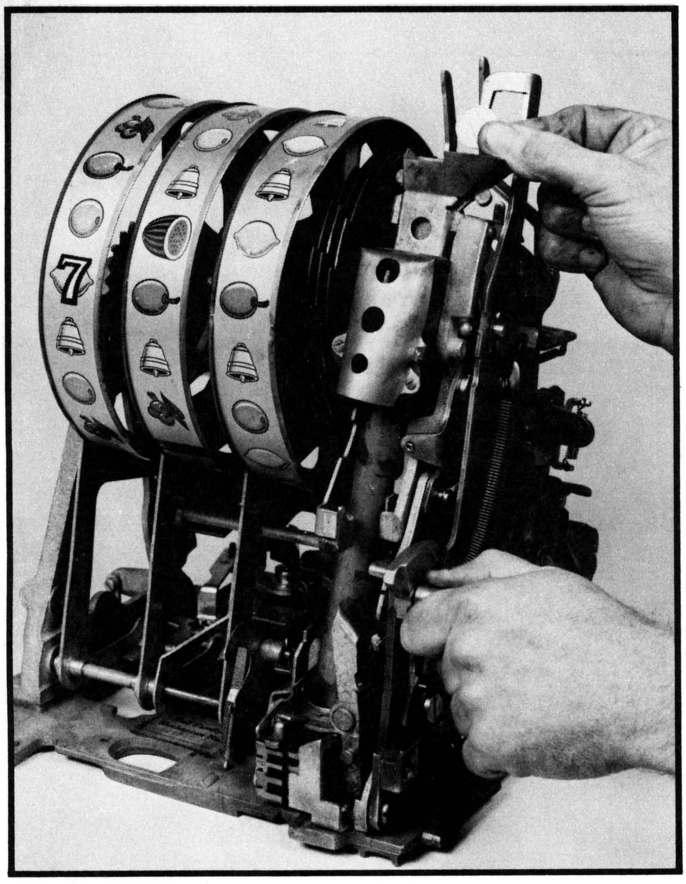


Figure 2.12

The coin tube is loaded by following the method illustrated in Figure 2.12. The main operating lever arm is depressed as far as possible with one hand while the other hand drops the coins into the top of the coin chute via the upper coin chute assembly. When the coin tube is filled, the coins will overflow and the loading of the coin tube is complete. Although it is not necessary to completely fill the tube, it *is* necessary to have the slides plus a portion of the tube filled to prevent possible coin tipping in the slides. Thirty to forty coins is usually sufficient for this purpose.

While the jackpot on this machine is self loading, it is desirable to manually fill the jackpot before operating the machine since the automatic loading feature does require a certain amount of time in play of the machine in order to fill the jackpot. If the jackpot is in good working condition it is a relatively simple matter to manually load it. Make certain that the jackpot door is closed. The closing of the jackpot door is accomplished by pushing firmly on the jackpot dump lever toward the front of the machine until it is latched in the forward position as viewed from the rear of the machine (see Figure 2.4, Arrow D). Coins may then be manually fed into the jackpot via the jackpot loading chute (see Figure 2.4, Arrow G). As this loading procedure continues, some of the coins will go into the reserve jackpot, some will fall into the main jackpot and a few will pass through into the cashbox compartment. Those coins passing into the cashbox compartment can be recycled and will eventually come to rest in one of the two jackpot compartments until both are full.

Unfortunately, very few jackpots are in perfect working condition because of the tension on the springs or missing or damaged parts within the jackpots themselves. However, despite these difficulties, it is still possible to load and have a "working" jackpot by providing alternate means for loading the jackpot itself. The easiest way to load a jackpot under such circumstances, is to construct a little cardboard chute and place it through the top opening of the jackpot mechanism with it terminating in the jackpot compartment itself. By placing coins on top of the cardboard they will slide into the jackpot and come to rest in the jackpot compartment. This may sound a little arduous, but after it has been done once it is a relatively simple and highly efficient method for filling the jackpot. Later in this book, when the theory of the operation of the jackpot is explained in detail, alternate methods for filling the jackpot will be demonstrated which do not necessarily require a cardboard slide.

Emptying the Coin Contents of the Machine

Emptying of the tokens from the special award chute is most easily accomplished by removing the mechanism from the case and actuating the award

token release arm five times, thereby assuring that all tokens are purged from the chute.

Coins in the coin tubes in the mechanism may be removed from the machine with the mechanism either in or out of the case with the same degree of simplicity. One method of removing the coins from the machine is to cycle the machine as described previously, and while holding the clock fan, place a combination of three bars across the payout line, thus dumping 20

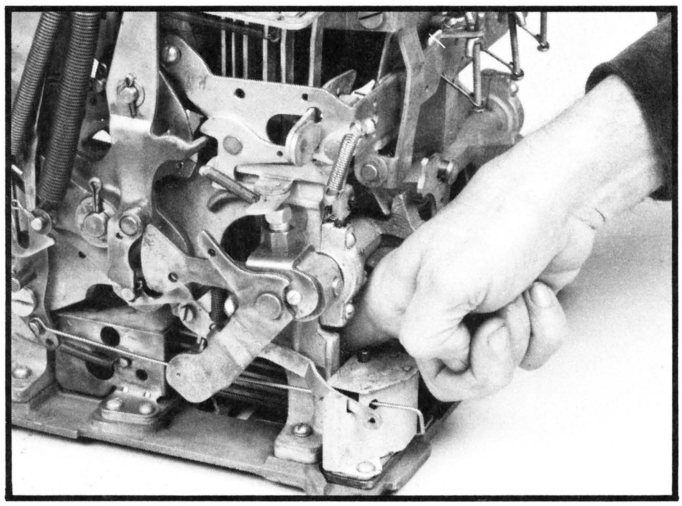


Figure 2.13

coins per cycle from the machine until the coin tube is completely exhausted of coins. An alternate method, and perhaps easier than this method, is to cycle the machine, manually holding *all* of the horizontal payout levers to the extreme left hand position as shown in Figure 2.13. Note that either method will result in moving all of the horizontal payout levers to the left, causing a jackpot to dump and thus empty it. If the machine has a reserve jackpot, it will be necessary to simulate two jackpots in order to empty the reserve as well.

Insertion of the Mechanism into the Case

Before attempting to place the mechanism inside the case, it is necessary that several things be done to prevent possible damage to the mechanism. First, make certain that the jackpot door is closed by securing the jackpot dump lever to the forward position and having it cocked in the case. Secondly, make certain that the mechanism has been cycled and that no pay out condition exists before inserting it into the case. Finally, make certain that the catches shown in Figures 2.1 and 2.2 are in their open position so as to provide proper clearance for the machine as it enters the case.

After having performed the checks in the previous paragraph, grasp the mechanism by the operating fork and upper coin chute assembly and carefully place it into the rear of the case, slowly sliding it into the forward portion of the case. The machine should not be forced in, but should be coaxed in gradually. Some binding may occur where the upper left-hand side of the mechanism interfaces with the escalator. Any binding which may occur can be alleviated by easing these parts together, while at the same time gently applying forward pressure to the base of the mechanism. The mechanism is then secured to the bottom of the case with the retaining clamps shown in Figure 2.2. Replace the back top of the case, and secure it with its clamps. Finally, replace the back door.

A final word of caution is in order. Never force the mechanism into the case. It should go in with a modest amount of pressure and coaxing; and if it doesn't, there is something wrong. Fix it rather than force it.

The Glossary

A pictorial glossary has been provided at the end of this book for rapid identification of every working part of the mechanism, escalator, jackpot, award token dispenser and case hardware. All these parts have been photographed in place with captioned arrows giving the standard nomenclature used in this book. It should be emphasized that the photographs in the glossary are given for identification purposes only and not to illustrate the working of the machine.

3 General Theory of Operation

Introduction

The slot machine has three basic cycles of operation: namely, the wind-up cycle, the release cycle, and the unwind cycle. Every time a coin is placed into the machine and the handle pulled, the slot machine will pass through all three cycles ending the particular play of that coin. In order to see the various cycles of the machine, it will be necessary to remove the reel assembly from the machine for better observation. The removal of the reel assembly is described in detail in Chapter 4 and is considered the first step in the disassembly of the mechanism. If the reader wishes to "follow along" it is suggested that the reel bundle be removed following the instructions provided in Chapter 4. After the reel assembly has been removed, the mechanism will appear as in Figure 3.1. The following description of the three cycles will be demonstrated by manually operating the mechanism with a screwdriver as explained in Chapter 2.

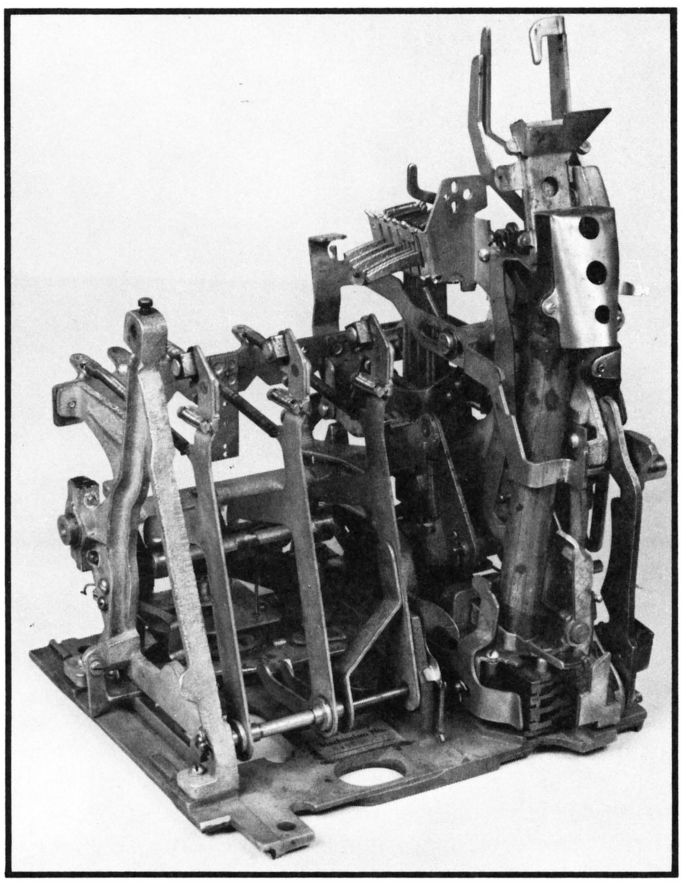


Figure 3.1

The Wind-Up Cycle

The wind-up cycle commences after a coin has been inserted into the escalator and the handle is pulled. If the escalator detects a valid coin it will signal this to the mechanism by inhibiting the coin detector operating lever from traveling forward. Figure 3.2 shows the main operating lever being depressed manually, the

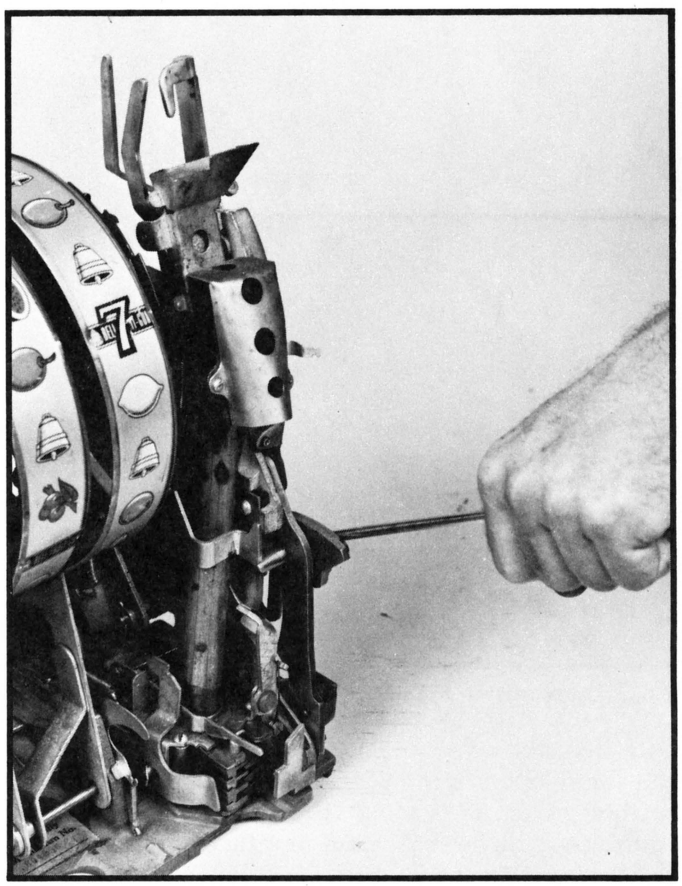


Figure 3.2

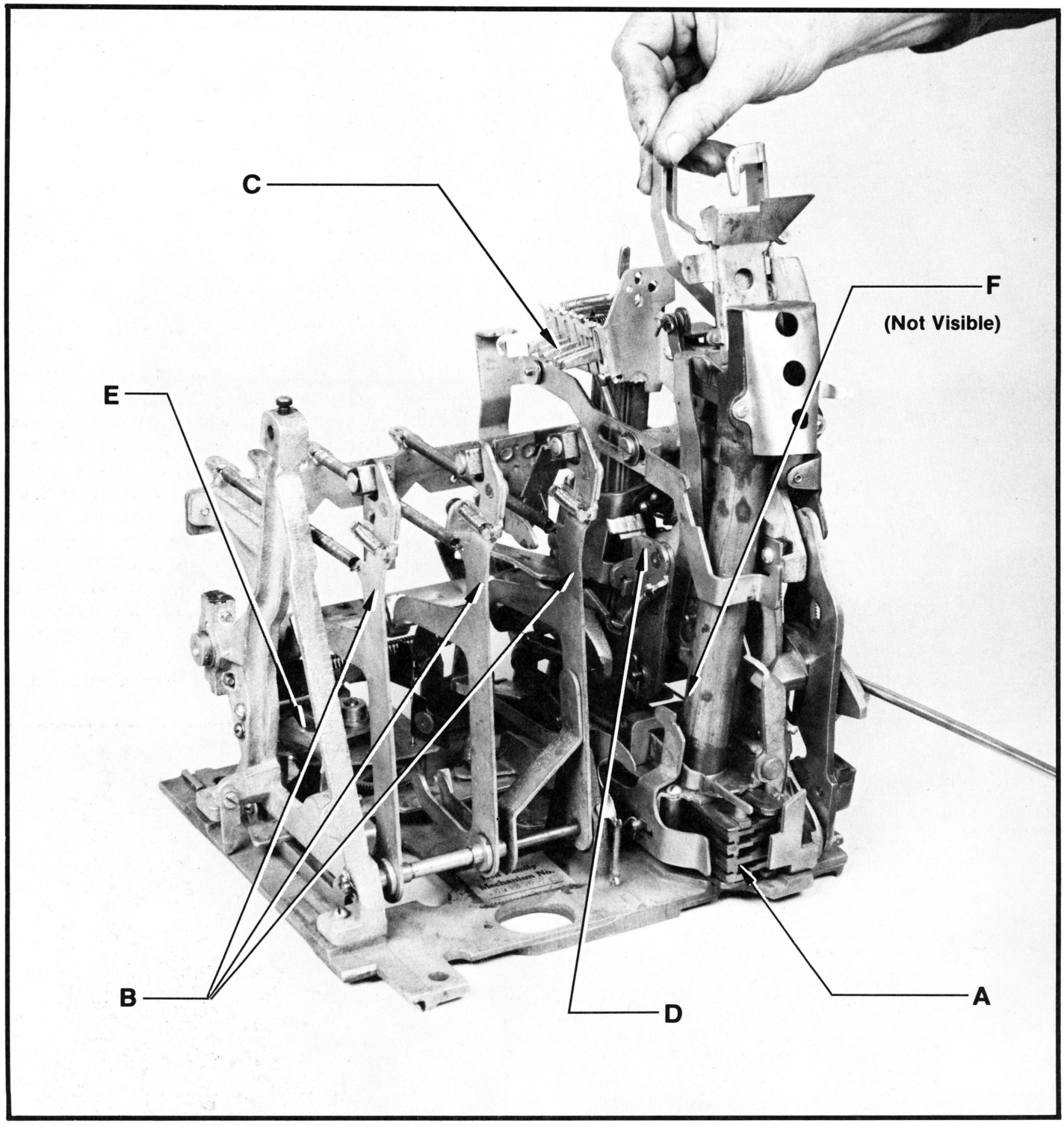


Figure 3.3

coin detector operating lever traveling forward and the main operating lever being locked in terms of further travel. Releasing the main operating lever causes the coin detector lever to return to its ready position as shown in Figure 3.1.

Next a screwdriver is used to wind-up the mechanism while keeping the coin detection lever bar from traveling forward, thus, simulating the presence of a valid coin in the escalator. While slowly winding up the mechanism, several functions are being performed as shown in Figure 3.3.

(A) The payout slides are being reset by traveling forward.

(B) The reel stop levers are moved forward and away from the starwheels.

(C) The vertical payout levers are pulled away from where the reel payout discs would be.

(D) The reel operating lever assembly (kicker) is cocked by traveling to a forward position in the mechanism.

(E) The clock is being wound up.

(F) The horizontal payout levers are re-positioning themselves in front of the payout slides.

After all of these functions have been performed, the machine is in a fully wound up state and is ready to be released as shown in Figure 3.4.

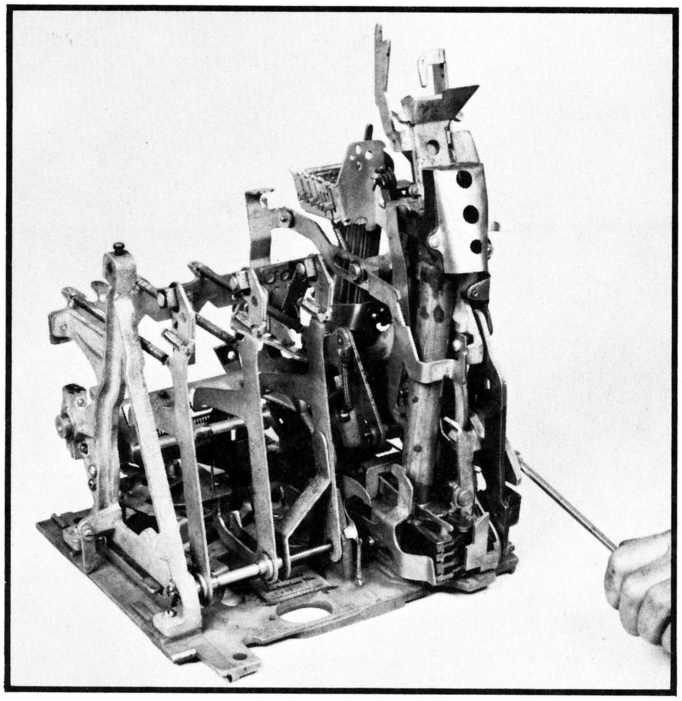


Figure 3.4

Release Cycle

While inhibiting the clock fan, thus, preventing rotation, the screwdriver is depressed further on the operating lever such that the machine is tripped. Immediately after doing this the machine will appear as shown in Figure 3.5.

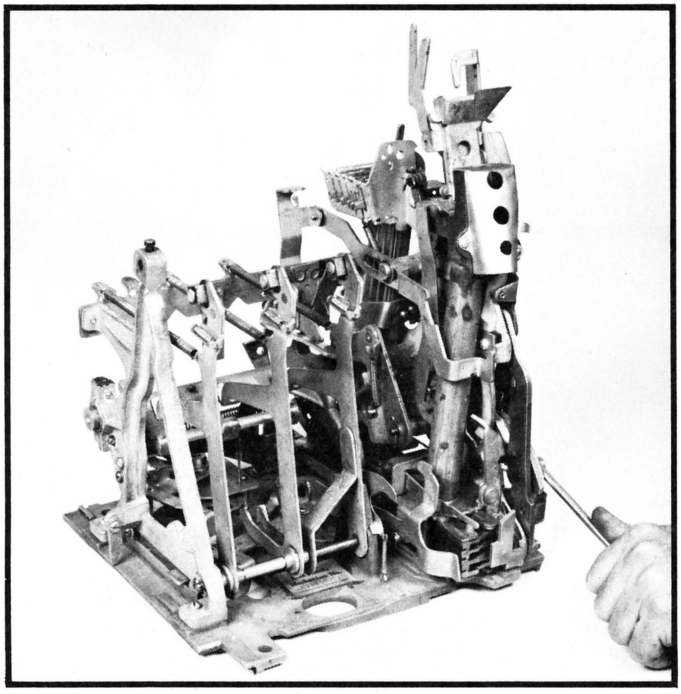


Figure 3.5

The release cycle performs two basic functions in the mechanism, which must be observed quickly to see them happen. The first function is the release of the reel operating lever assembly which engages the three reel discs (if they were present) and thus, imparts rotating motion to the three reels. The second function is the release of the operating fork, and thus the starting of the clock in motion and the beginning of the unwind cycle.

The Unwind Cycle

The unwind cycle can best be witnessed by slowly releasing the clock fan, a few turns at at time and watching what happens to the mechanism as it unwinds. There are five basic steps to the unwind cycle, and they are frequently referred to as the five clicks. As the clock is allowed to unwind, the three reel stop levers will be allowed to drop or spring back into their stopping positions one at a time, from left to right, thus stopping each of the three reels. Figure 3.6 shows the mechanism after the first two reel stop levers have dropped into position, but not the third. While this procedure is taking place, the clock fan blade is being manually controlled by allowing the clock to run only a few revolutions at a time so that each of these steps or clicks can be followed.

After the third reel stop lever has been retracted to

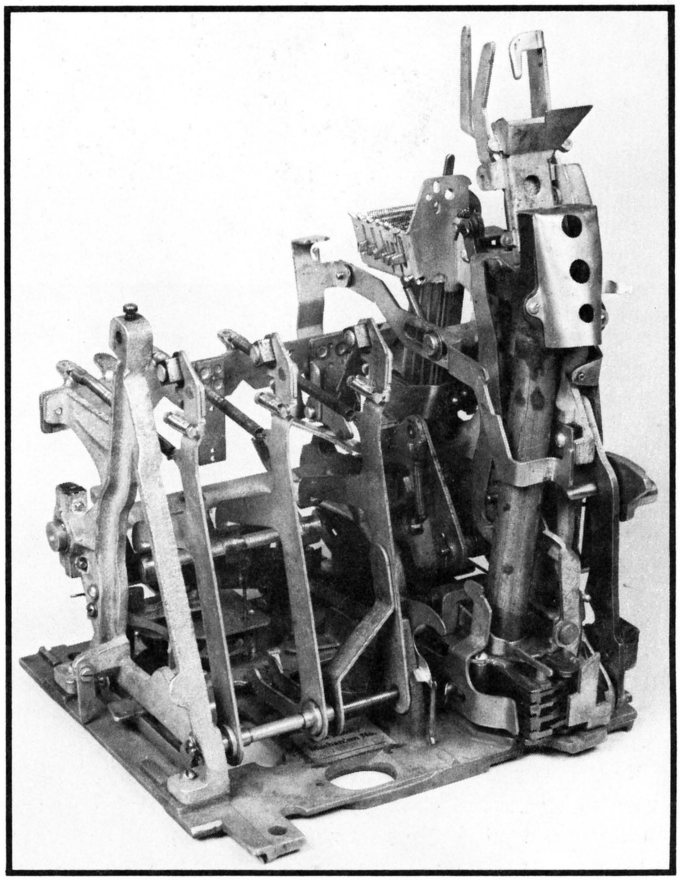


Figure 3.6

its stopped position, the next event will be the vertical payout levers traveling into the reel discs to determine what paying combination, if any, has been achieved by the stopped reels. In this case, since there is no reel assembly in the mechanism, all of the vertical payout levers will travel all the way into the area where the reel discs would normally be, thus simulating the condition of a jackpot. Figure 3.7 shows the mechanism just after it has wound down enough for the fourth step or click to have occurred, and the vertical payout levers (in this case, all of them) have entered into the reel disc area.

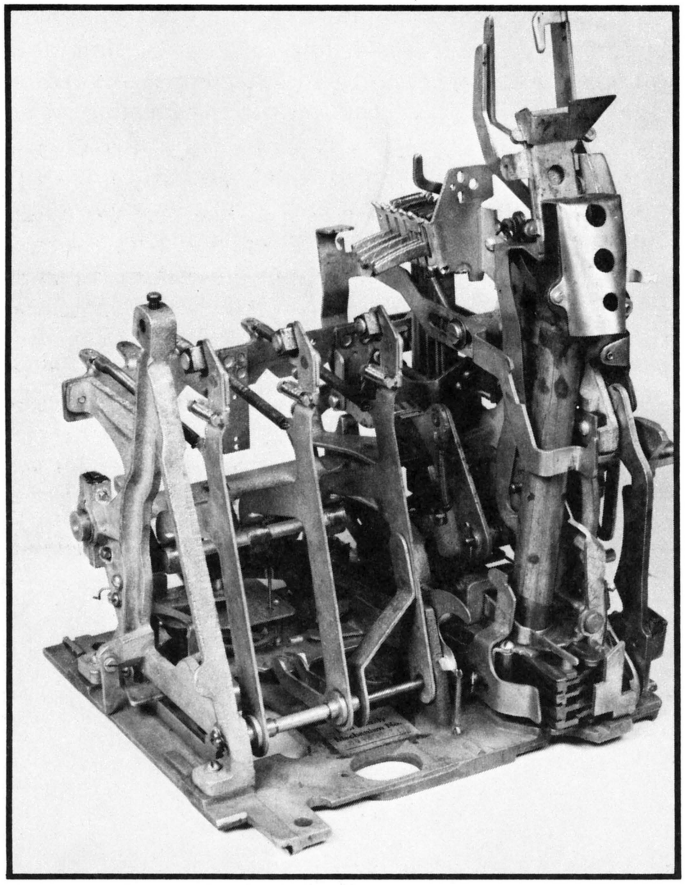


Figure 3.7

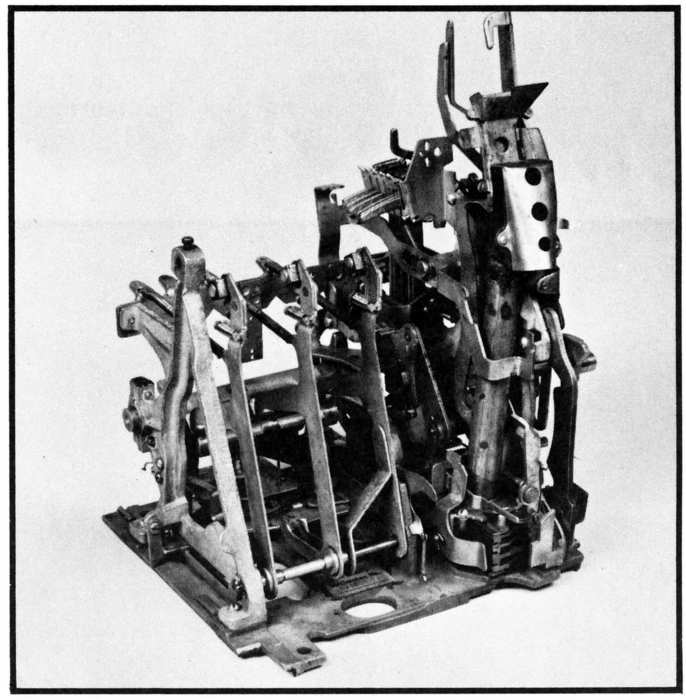


Figure 3.8

The vertical payout levers have mechanically signaled to the horizontal payout levers which slides are to be released during the fifth step. In this case the vertical payout levers have signaled that a jackpot has occurred. As the machine is allowed to wind down and go through the fifth step, all of the payout slides will be released simulating a jackpot. Figure 3.8 shows the machine after the fifth step has been completed. Completion of this fifth step during the unwind cycle completes the total cycling of the mechanism for any given play.

Once an understanding of these three cycles has been accomplished, then the basic understanding of the operation of the slot machine is well in hand. In succeeding chapters, more details of how these cycles are accomplished will be explained. Ancillary functions which occur during these cycles will be explained, but their functions do not interfere with the three basic cycles just explained.

4 Lubrication of the Operating Mechanism

Introduction

The science of lubrication is very complex and is far beyond the scope of this book. The basic idea, however, is simple: to provide fluid separation (by means of a lubricating film) of two mating, moving surfaces, lowering the coefficient of friction and reducing wear.

The ideal and proper time to lubricate the mechanism is upon reassembly, after it has been completely disassembled and thoroughly cleaned. It is desirable, however, and sometimes necessary to lubricate the mechanism without resorting to complete disassembly, and this chapter concerns itself only with interim lubrication without complete disassembly.

The greasing and oiling of the mechanism without complete disassembly can be accomplished without removing the reel assembly, however, explanations of the greasing and oiling of certain areas will be facilitated by having the reel assembly removed. Additionally, it is recommended that the reel assembly be removed for ease in lubricating the mechanism. The technique for removing it is described in the following section.

Reel Assembly Removal

The removal of the reel assembly (sometimes called the reel bundle) is described here in detail and referred to elsewhere in this book as the first step in the disassembly of the mechanism.

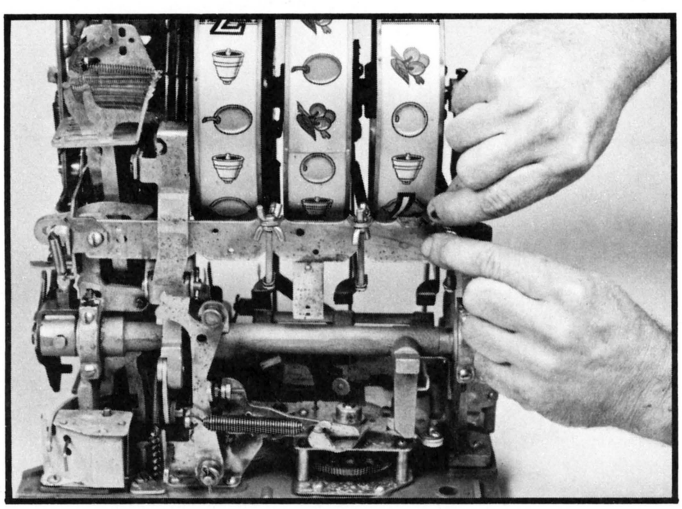


Figure 4.1

The first step in the removal of the reel assembly is to disconnect the three brakes as shown in Figure 4.1. By unscrewing the top wing nut, the brake can be easily removed by pulling it back and away from the machine. On some machines these brakes will be missing, and they are not imperative to the operation of the machine.

The next step is to partially cock the mechanism in order to remove the reel stop levers from the reel bundle. Figure 4.2 shows the method for the partial cocking or wind-up of the mechanism. The screwdriver technique is used as if the machine was going to be

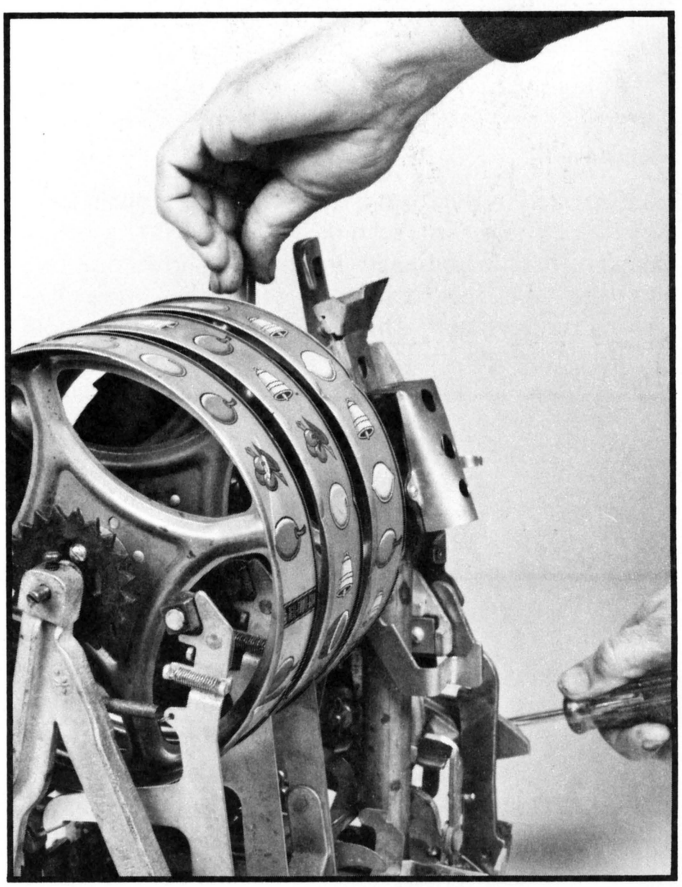


Figure 4.2

cycled. This time, however, the screwdriver is not fully depressed and is pressed down only far enough to allow the reel stop levers to take a position approximately one inch away from the starwheels on the reel shaft assembly, as shown in Figure 4.2, and for the vertical payout levers to be fully retracted from the reel discs.

The next step is to remove the reel assembly from the machine. Figure 4.3 shows the loosening of the screw holding the reel shaft. Once this screw has been loosened, a screwdriver may be inserted into the end of the reel shaft and it can be unscrewed, allowing it to be pulled out. It should be noted that there are different ways that the reel shaft may be connected to different styles of machines. Most earlier machines will have two screws, one at each end of the reel shaft, and in this case both screws are loosened, and the reel

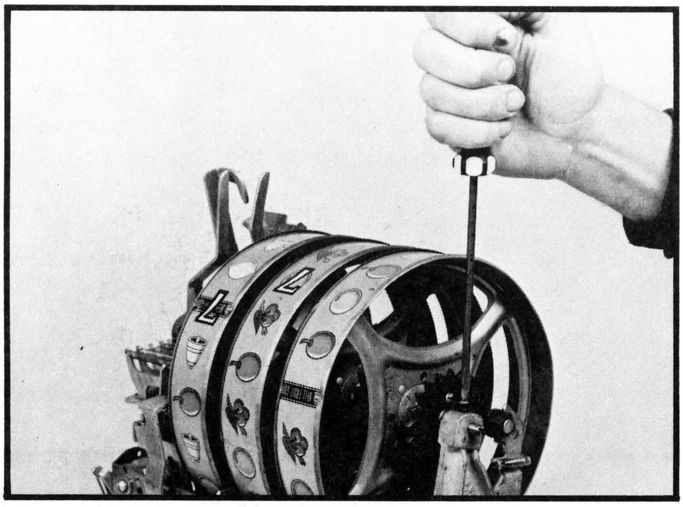


Figure 4.3

shaft merely pulled out rather than unscrewed.

The next step in the removal of the reel assembly requires a little patience. Figure 4.4 shows one hand grasping the reel assembly while the other hand grasps the reel shaft and removes it from the mechanism. After the reel shaft has been completely re-

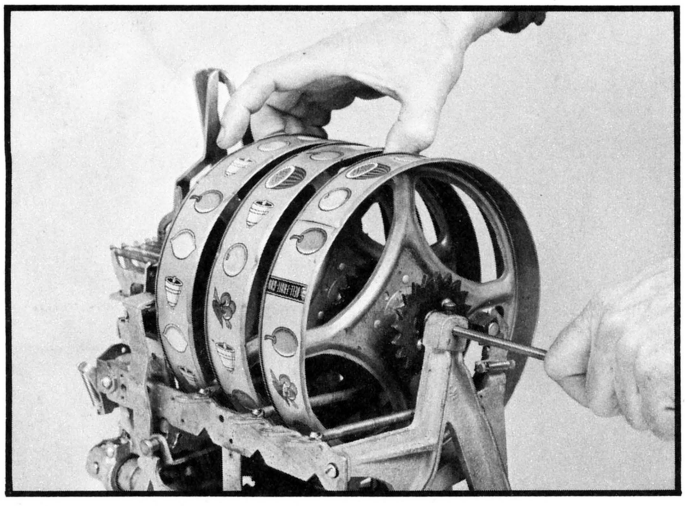


Figure 4.4

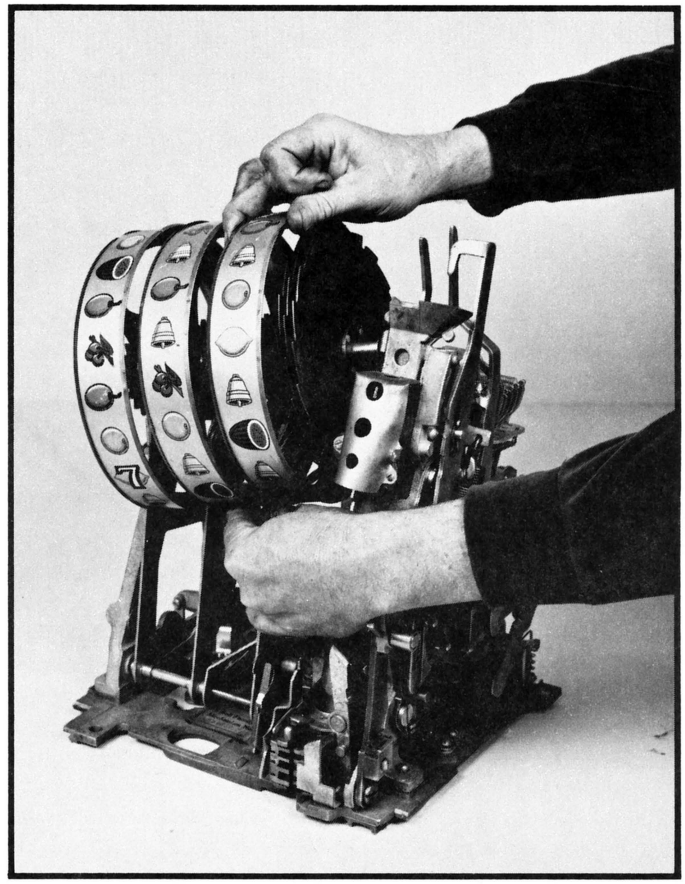


Figure 4.5

moved, the reel assembly must be gently worked out and away from the machine. This may require spreading the reels themselves as shown in Figure 4.5 to allow them to clear the stop lever arms. At no time, however, should anything be forced during this proce-

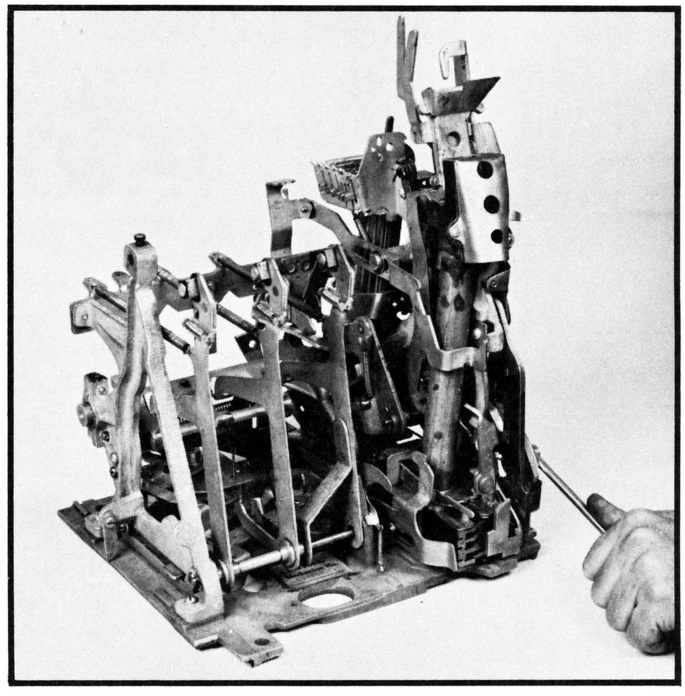


Figure 4.6

dure; each part should be gently eased and worked out. While this may seem difficult the first time it is attempted, with a little practice the process becomes very simple and routine.

After the reel assembly has been removed, the mechanism will appear as in Figure 4.6, with all of the internal working parts of the mechanism exposed. The machine should then have its operational cycle completed by finishing the wind-up cycle using the screwdriver as a handle. After the mechanism has

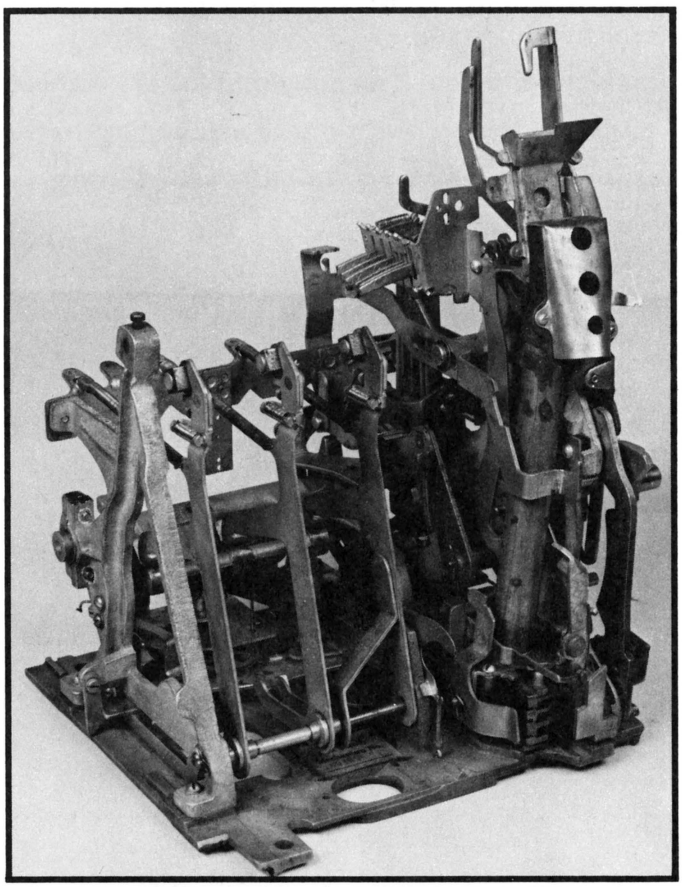


Figure 4.7

completed its full cycle it will appear as shown in Figure 4.7.

Exposing the Center of the Mechanism

Greater access to the interior parts of the mechanism can be achieved if the reel stop levers are swung out of the way. This is accomplished by disconnecting their extension springs as shown in Figure 4.8, leaving the levers as shown in Figure 4.9.

Lubricating the Mechanism

The mechanism should be oiled and greased as a function of the amount of use, but as a general rule of thumb it should be lubricated every six months. Even though the occasional use of the machine may not wear the lubricants away, it should be remembered that oil and grease oxidize, and some lubricants evaporate and harden with time and therefore need to be replenished.

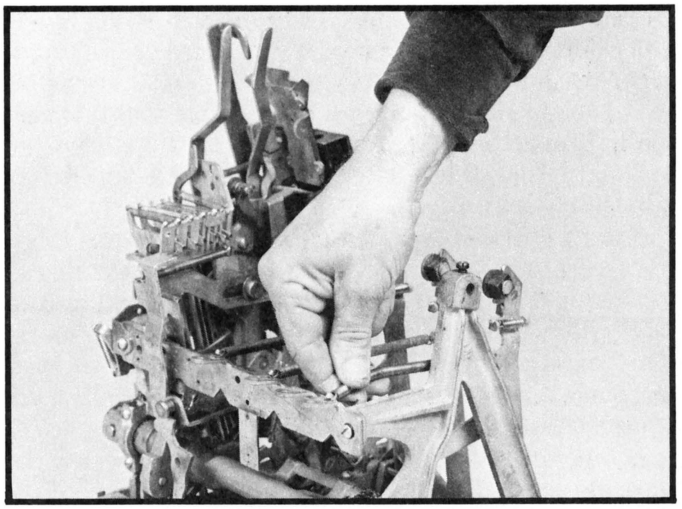


Figure 4.8

Light weight oil such as "sewing machine oil" or "gun oil" should be used on the clock bushings and all the mechanism's light duty bushings and pinions. Shoulder screws and bearings should be lubricated with a somewhat heavier oil such as Shell Vitrea Oil

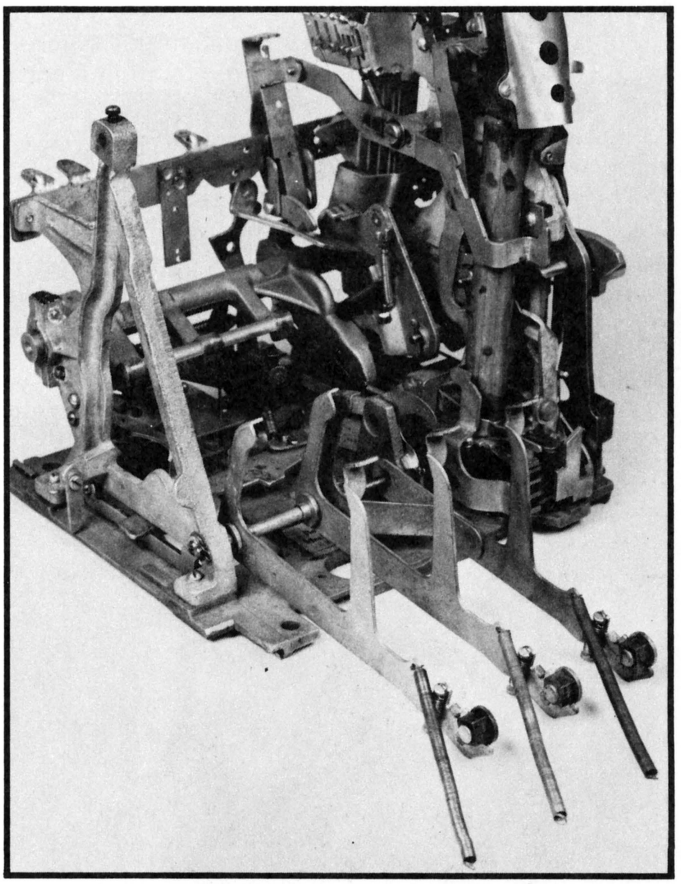


Figure 4.9

69 or Mobil Vactra Extra Heavy. Machine oils (rather than motor oils) should be used whenever possible. Motor oils contain additives required only in high speed internal combustion engines operating at high temperatures. Some of these additives can actu-

ally be harmful when not used for high temperature lubrication.

Bearings which can be reached by partial disassembly (such as the operating fork bearings) must be partially disassembled and grease placed directly in the journals; "painting" grease on the outside surfaces is absolutely useless.

On the heavier wearing parts and larger bushings, grease should be applied. It should be remembered that grease does not "run"—the only grease that is in use is that which is placed *between* the moving parts. On bearings which cannot be disassembled without extreme difficulty (such as the main operating lever shoulder stud and roller), place a few drops of heavy machine oil between the mating surfaces, working the mating internal surfaces back and forth to encourage the oil to "wick" its way between the two surfaces. Then apply grease around the outside of the mating parts This will serve two basic functions: it will seal in the oil; and a small portion of the grease will be carried into the joint by the oil.

An excess of grease "painted" around parts serves no useful purpose but only collects dust and dirt. The type of grease to be used should be a high quality ball-bearing or cup grease.

Oil is superior to grease as a lubricant unless melting (produced by a complex combination of film pressure and temperature) takes place. Therefore its use as a lubricant for slot machines should be confined to those areas where oil would eventually run away.

There are two mating surfaces on the slot machine which should ideally be coated with a *mild* extreme pressure (EP) lubricant: between the operating fork stop pin and dog, and between the end of the payout slide lock and front of the bottom (main) payout slide. Be very selective with this type of lubricant, however, since it can cause problems if it reaches other parts.

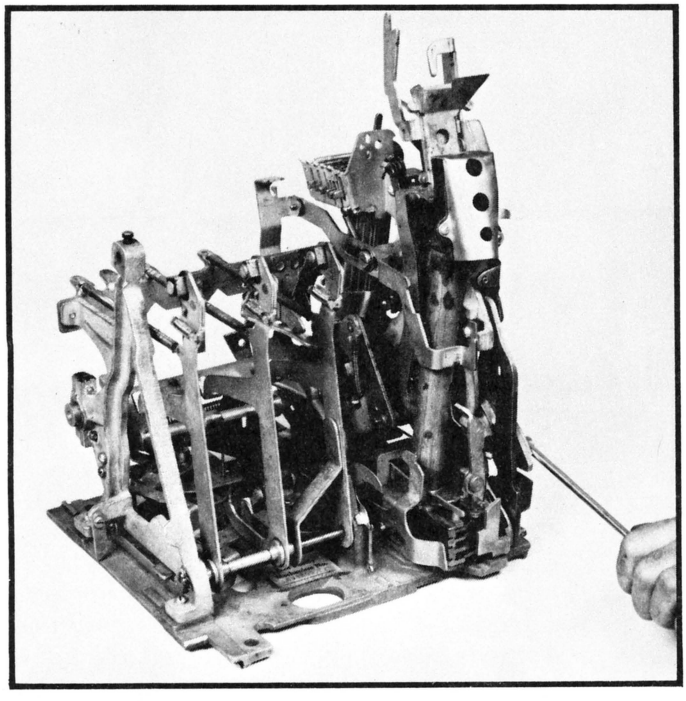


Figure 4.10

Parts associated with the coin system such as the payout tube and the payout slides, should never be greased or oiled. These parts should only be cleaned with a fast-evaporating solvent and polished dry with a soft cloth.

WD-40, Liquid Wrench and similar penetrating-type oils are excellent for freeing mirey or gummy oils or greased parts, but they do not supply long lasting or good lubrication.

Installing the Reel Assembly into the Mechanism

The first step to be performed in installing the reel assembly is to reconnect the reel stop lever springs as shown in Figure 4.8. The next step is to fully wind the mechanism up as shown in Figure 4.10, insuring that the reel stop levers are pulled away as far as possible from the reel assembly and that the vertical payout levers are retracted away from the potential area to be occupied by the reel discs. Grasp the reel assembly and gently insert it back into the mechanism as shown in Figure 4.11. Make certain that the second and third reel stops levers find their way between the reels. While loading the reel assembly into the mechanism, make certain that the discs are clearing the reel operating lever and the disc stop lever at the rear of the

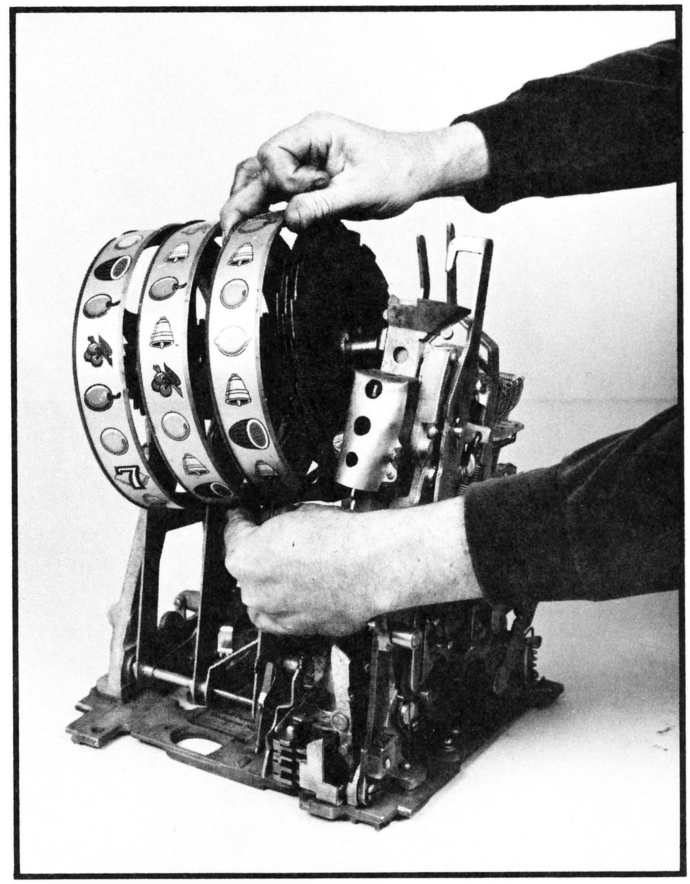


Figure 4.11

mechanism. Once the reel assembly has been positioned in approximately the correct position, the reel shaft can be reinserted into the mechanism frame and through the reel assembly, shown in Figure 4.4. After final tightening of the reel shaft by a screwdriver, the set screw can be tightened as shown in Figure 4.3. Allow about .005″ to .015″ axial clearance between the side frame and the longest concentric shaft. Finally, the drum brakes, if they have been removed, should be replaced as shown in Figure 4.2.

Brake Adjustment

Brakes should be adjusted while cycling the machine to provide proper tension on the rotating reels such that when the reel stop lever engages the reels, the rotational velocity is not so great as to cause severe jarring and wear and tear on the parts. This is easily accomplished by adjusting one brake at a time and placing enough tension on it such that there is still some motion of the reel before the reel stop lever engages the reel. It should be noted that the reel should still be spinning when the reel stop lever engages, but not with exessive speed. Sequencing of the reels stopping from left to right is accomplished by the mechanism itself and not the brakes; the brakes only control the speed of the spinning reels when the reel stop levers engage them.

If the reel assembly has a sluggish motion while the reels are spinning, it is then recommended that the reel assembly be overhauled as described in Chapter 9, since there is no simple way to oil the reel assembly in its current configuration.

5 Cleaning of the Mechanism

Introduction

The previous chapter dealt with the oiling and greasing of the mechanism with the reel assembly removed. This chapter considers the cleaning of the mechanism before lubrication. The point of departure for this chapter begins with the reel bundle removed as explained in Chapter 4 and the reel stop lever springs disconnected, thus laying open the mechanism. In order to perform an adequate job of cleaning the mechanism, it will be necessary to remove the clock assembly and the coin slide assembly. Each of these two assemblies will be cleaned separately from the remaining portion of the mechanism. Different techniques are used in cleaning these assemblies and each will be explained in detail, including their removal and replacement.

The clock and the slides should be cleaned with a relatively caustic cleaner. For this purpose a one gallon can of carburetor cleaner, or some similar chemical, is highly recommended. The remaining portion of the mechanism needs to be scrubbed down with solvent to wash away dirt and grease and other foreign particles. For this washing a general machine cleaning solvent should be used, such as mechanic's solvent, lacquer thinner or printers type wash; these products are readily available from chemical supply houses. These solvents are usually very flammable and poisonous and should be used outdoors with adequate ventilation. In addition, the slides should be wiped clean with a fast evaporating solvent.

Clock Removal and Cleaning

The clock is mounted to the base of the machine by four screws, two in the inside of the base and two at the rear of the base. The two inner screws are removed as shown in Figure 5.1. The reel timing lever connecting link is removed from the clock as shown in Figure 5.2. The clock spring is removed by manually stretching it and lifting it off of its holding bracket, as shown in Figure 5.3. Remove the timing lever connecting link as shown in Figure 5.4. The clock is now free of the mechanism except for the two rear screws which are now removed. The clock is now free to be

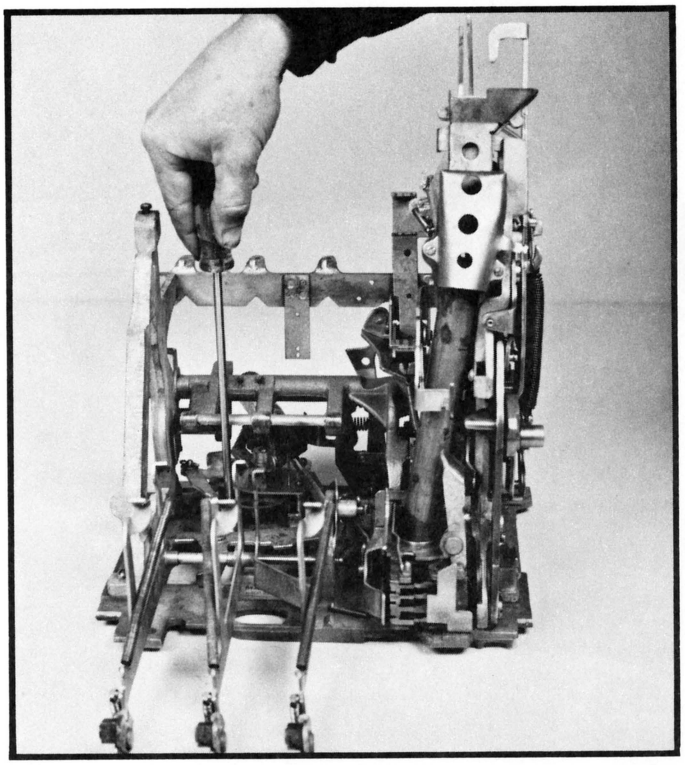


Figure 5.1

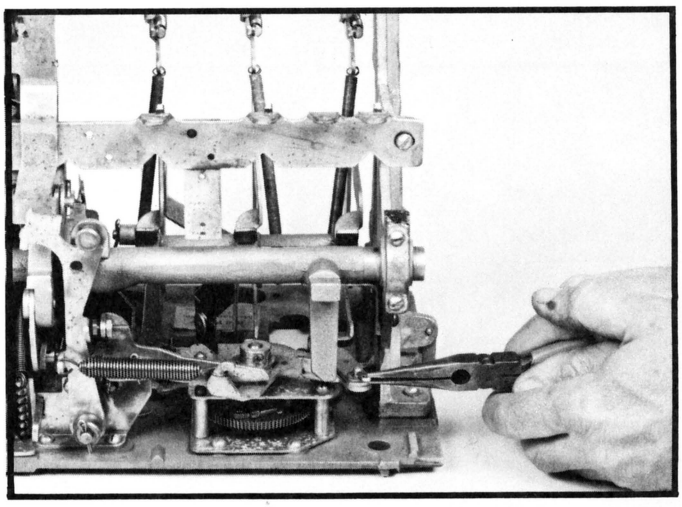


Figure 5.2

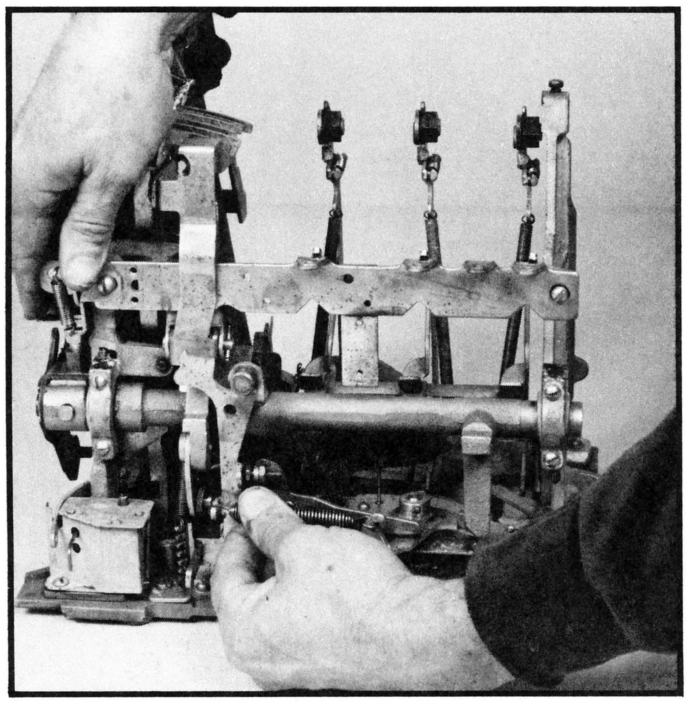


Figure 5.3

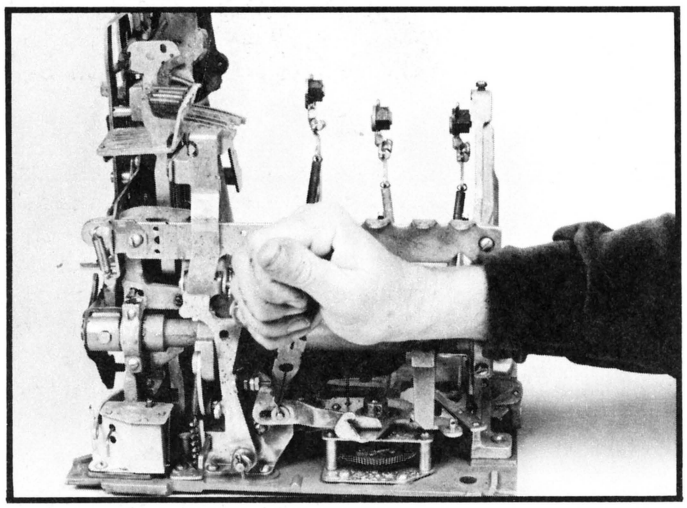


Figure 5.4

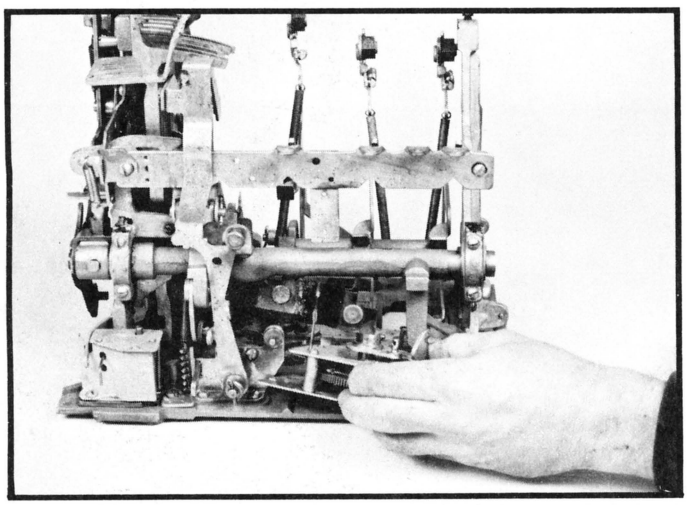


Figure 5.5

removed as shown in Figure 5.5. Do not attempt to force the clock out of the mechanism. With a little bit of twisting, turning and positioning of the clock fan in the proper position, the clock will slide out and back, free of the mechanism.

The complete clock assembly should now be placed in the carburetor cleaner and be allowed to boil for approximately thirty minutes, agitating it every five or ten minutes. Caution should be used in the handling of this highly caustic solution, since it can cause severe skin and eye damage upon exposure. After removing the clock from the carburetor cleaner, rinse it immediately with solvent to get rid of any residual carburetor cleaner that may still be present. There may be additional globs of grease still remaining, and these can usually be brushed away with a small toothbrush and solvent. The clock should then be allowed to dry thoroughly before being oiled. This drying process may be accelerated by using either a hair dryer or a compressed air gun if available. Once the clock has been dried thoroughly, lubricate all of the clock bearings with a light weight machine oil, such as gun oil or sewing machine oil. The gears should be oiled with a medium weight machine oil, but not greased.

In some instances it may be necessary to further disassemble the clock. This is accomplished by first removing the three screws holding the clock plates together as shown in Figure 5.6. The front and the back plates of the clock can now be separated allowing the total disassembly of the clock as shown in Figures 5.7 and 5.8. It should be noted, however, that the complete dismantling of the clock is not necessary or recommended for normal clock cleaning and should only be done when repair to the clock mechanism it-

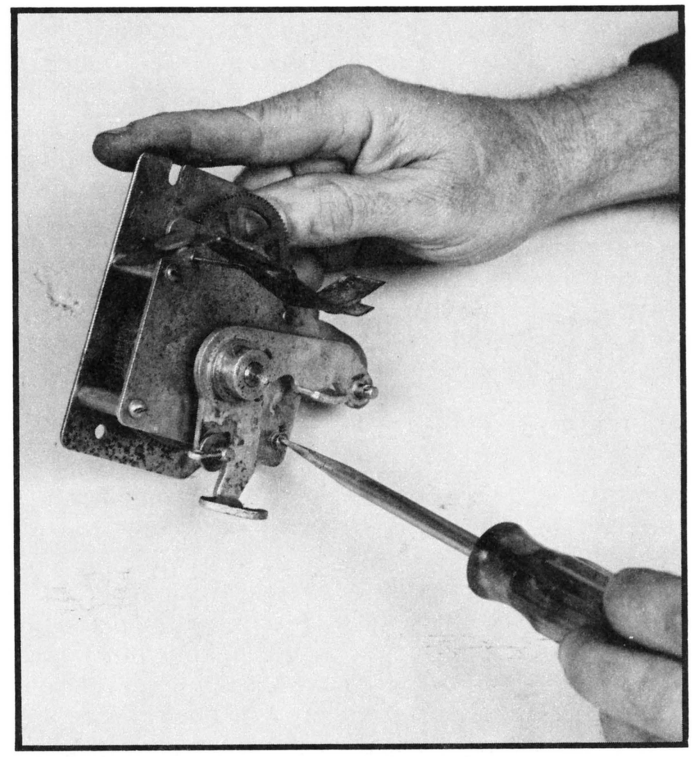


Figure 5.6

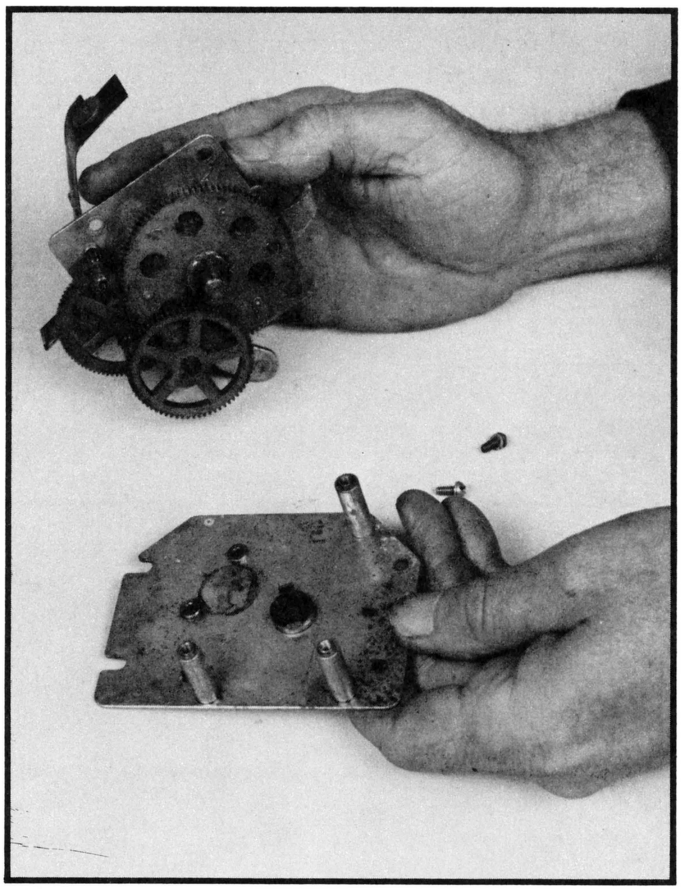


Figure 5.7

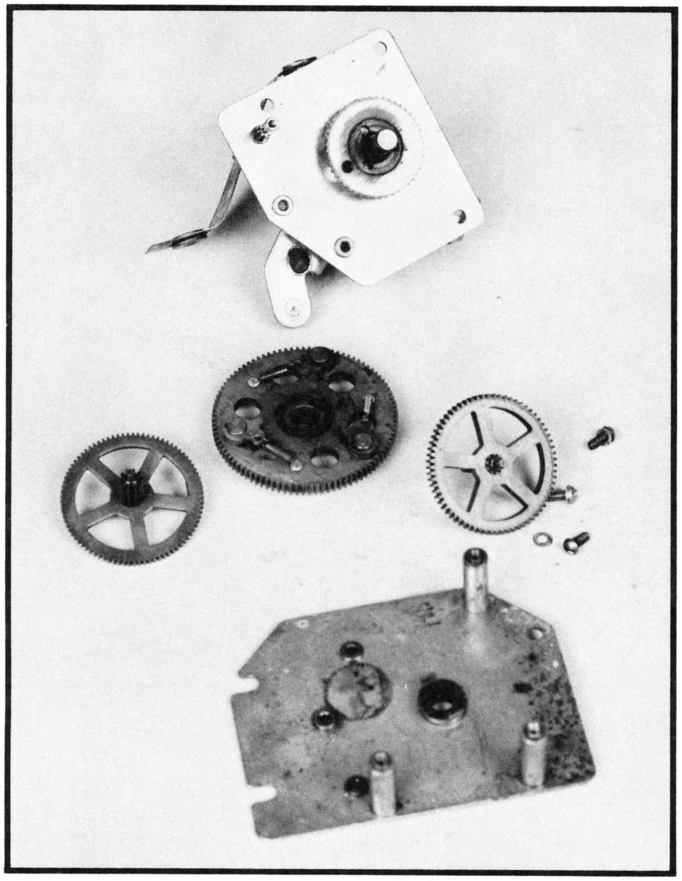


Figure 5.8

self is required.

The clock is rebuilt by rebuilding the gear train of the plate with the fan and then carefully fitting the other plate onto it. Fortunately there is only one way that the gears can fit together.

Coin Tube

In order to remove the coin tube it is necessary to gain access to the screw holding it to the frame of the mechanism. This is accomplished by first moving the

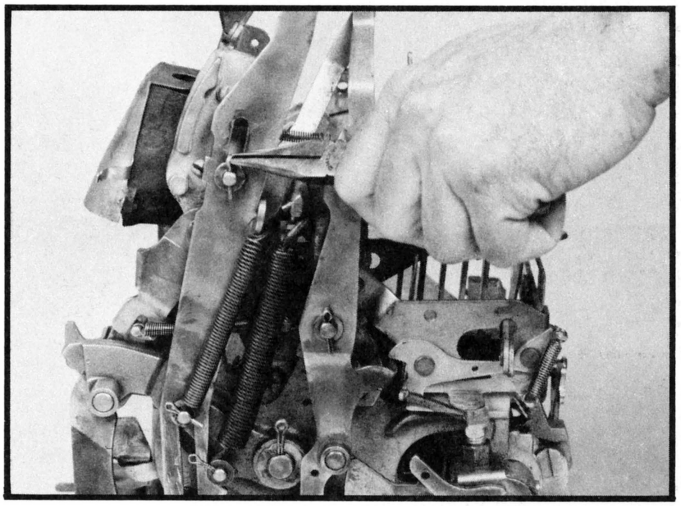


Figure 5.9

coin advance bar operating lever temporarily out of the way. First remove the cotter pin from the shoulder stud as shown in Figure 5.9; then pull the lever back, as shown in Figure 5.10, exposing the screw holding the coin tube assembly to the frame. After this screw has been removed, the coin tube assembly can be lifted free by pulling back the coin tube shutoff lever with one hand while removing the coin tube assembly with the other as shown in Figure 5.11.

The coin tube can be cleaned by running a rag

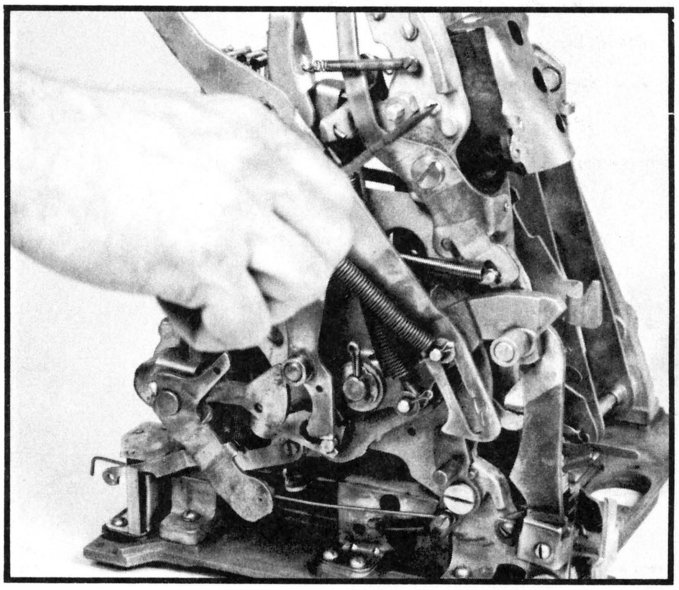


Figure 5.10

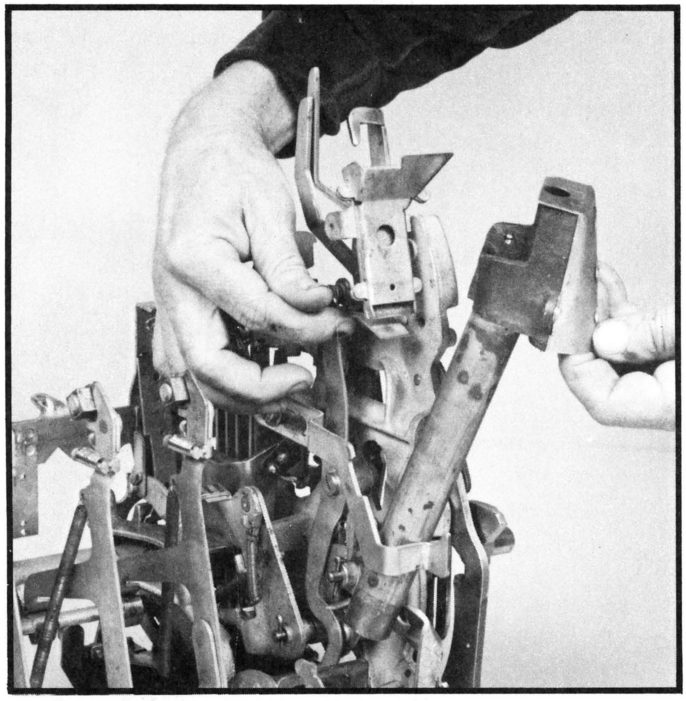


Figure 5.11

through it that has been dampened with fast evaporating solvent, and once having been cleaned in this way it should dry almost immediately. The main reason for removing the coin tube, however, is to provide easy access for the removal of the payout slide assembly.

Payout Slide Assembly Removal

The first step in the removal of the payout slide assembly is to disconnect the payout slide springs where they are fastened to the bracket at the rear of the

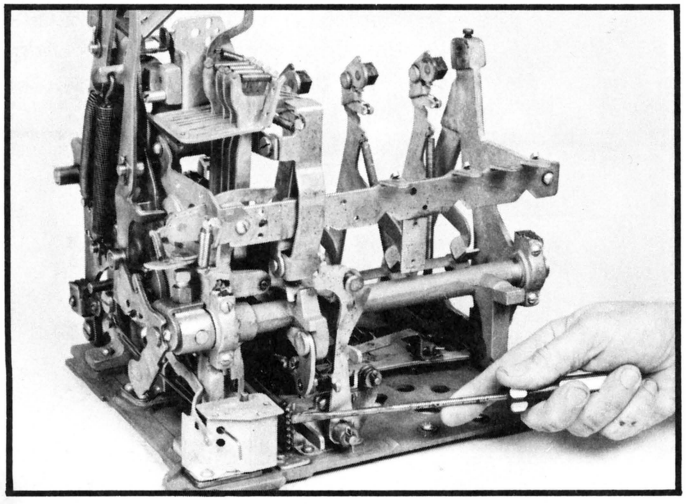


Figure 5.12

mechanism. This is accomplished by using a screwdriver and prying each spring off of the holding bracket as shown in Figure 5.12. It should be noted that the top spring on this bracket actually runs to the reel operating lever assembly, but it needs to be removed since there is usually a payout slide spring un-

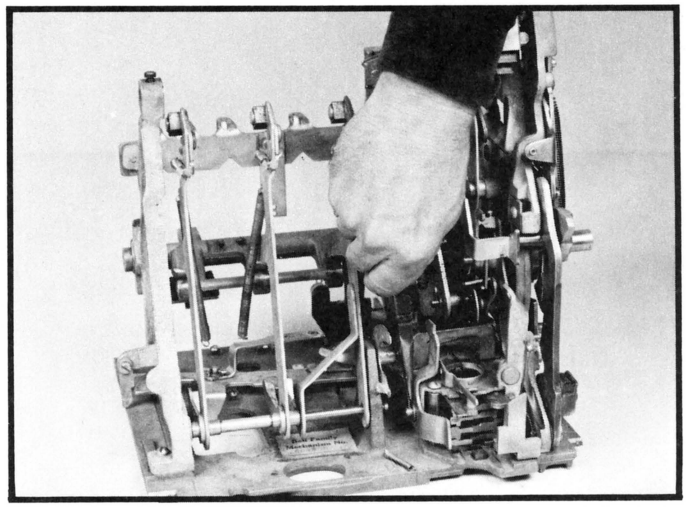


Figure 5.13

derneath it. Working from the front of the machine, first remove the cotter pin and then slide away the jackpot pushbar as shown in Figure 5.13. Now remove the four screws which hold down the payout slide coverplate as shown in Figure 5.14. Once the

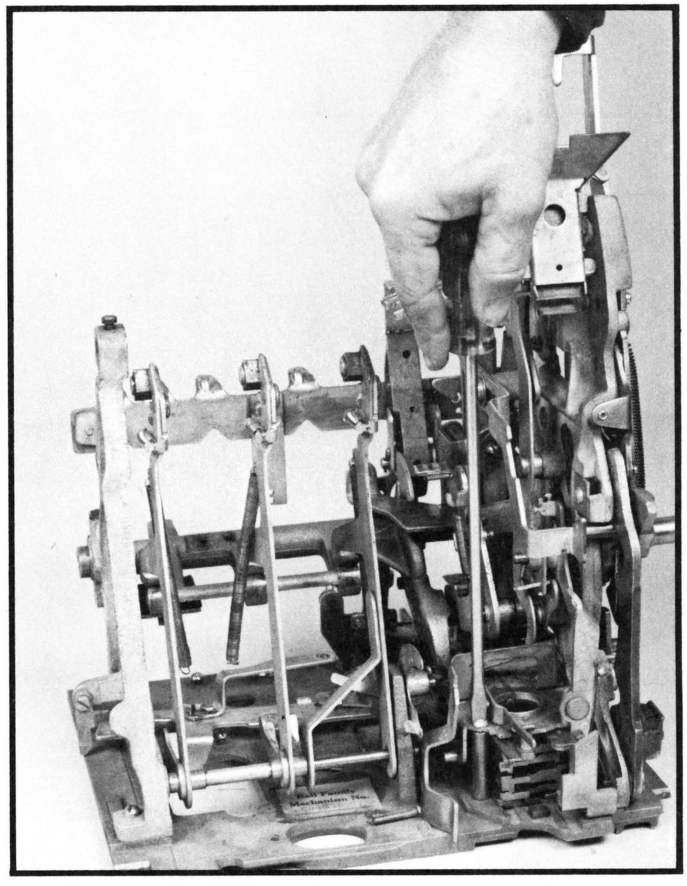


Figure 5.14

four screws have been removed from the coverplate it can be angled and coaxed out of the machine as shown in Figure 5.15. The slides can now be removed from the mechanism. It is best to keep these slides together and not separate them since their relative order

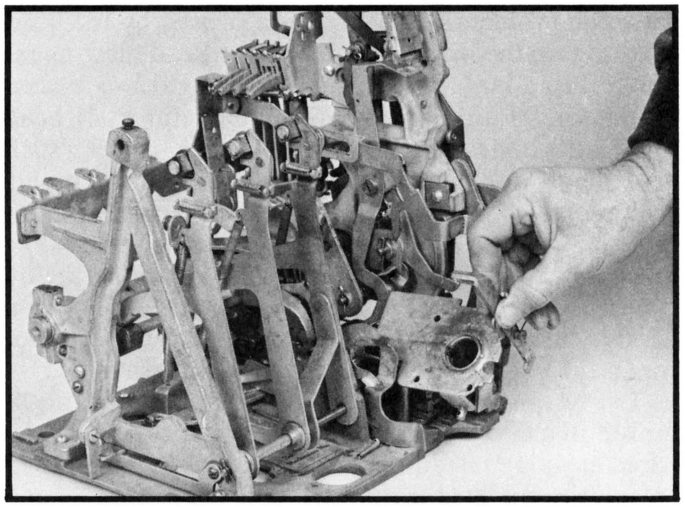


Figure 5.15

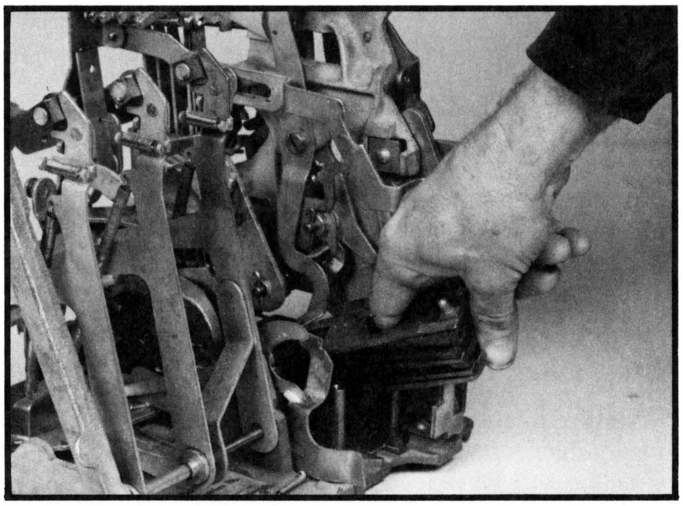


Figure 5.16

is important, not only to preserve the mathematical payout, but also to keep those wearing parts together which have worn together over the years. The slides are easily removed by reaching down with the forefinger and grasping all of the slides at once, removing them as a group as shown in Figure 5.16. After the slides have been removed from the mechanism, it is a good idea to put a piece of bailing wire through all of them as shown in Figure 5.17. The wire serves two functions: it preserves the relative order of the slides, and it provides a hook for dipping them in the carburetor cleaner.

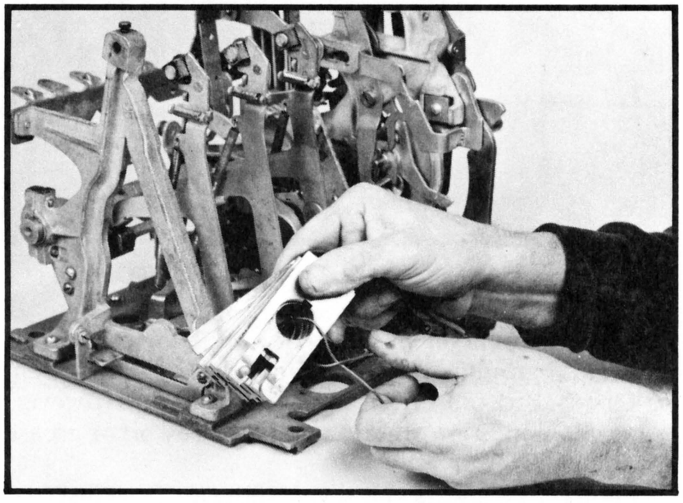


Figure 5.17

The slides and coverplate which have been loosely wired together should then be dipped in carburetor cleaner for approximately thirty minutes, agitating occasionally. After removing the slides and the top coverplate from the cleaner, immediately clean them with solvent in order to wash away any residual traces of the carburetor cleaner. The slides should then be allowed to dry thoroughly. Drying may be accelerated by either using a hair dryer or a compressed air gun. When the slides are dry they should be separated and carefully laid out to preserve their order. Each slide should then be *carefully* wire brushed to remove corrosion (only if any is present) and wiped clean with a fast evaporating solvent to insure removal of all possible traces of dust or grease. After the slides have been thoroughly cleaned, they should be stored in a safe place, preserving their order until they are ready for assembly back into the main portion of the mechanism.

Main Frame Cleaning

At this juncture of the mechanism cleaning process, several decisions need to be made. The first decision is whether to leave the machine torn down the way it is and proceed with the cleaning of the main frame, or to further tear down and dismantle the remaining parts from the main frame as described in the succeeding chapter. If the mechanism is in relatively good working condition, then a thorough cleaning with the mechanism intact will probably be functionally adequate. However, if excessive wear exists and certain mechanical components need either to be replaced, repaired or rebuilt, then it is probably better to completely tear down the mechanism and then clean it. Another factor in deciding the method of cleaning the mechanism is one of cosmetics. A much more thorough and cleaner job can be performed if the mechanism is completely disassembled, rather than cleaning the mechanism as it stands. However, the decision is a subjective one, and needless to say, tearing the mechanism completely down and doing a more thorough cleaning job involves considerably more hours than cleaning it as it stands.

Regardless of whether further disassembly of the mechanism will be done, some discussion of possible ways of cleaning the mechanism is worthy of discussion. The major ways of cleaning the mechanism will be enumerated with the pros and cons of each method as well as recommendations.

Replating: Without question, the ultimate way to clean and restore the mechanism is to completely dismantle the mechanism and recadmium plate each and every part. The problem with this method is not one

of cost so much as it is time, since every major moving piece, such as bearings, need to be masked where relative motion is involved, since the cadmium plating process tends to change the dimensions of the parts. This is not to say that it cannot be done, and there is no question that it is the ultimate way for the mechanism to be cleaned and restored. If you have the time and inclination, by all means do it and you will have, without a doubt, a machine in Grade 1 condition.

Solvents: Cleaning the mechanism with solvents can be accomplished either with the mechanism assembled as it is or by completely disassembling and then washing with solvent. A convenient way to clean the mechanism with solvent while assembled is to use an air gun in conjunction with a siphon and a five gallon can of cleaning solvent. Spray the solvent over the mechanism and then brush the mechanism with a stiff brush. By repeating this process several times, you will eventually get 99% of the grease and grime off of the mechanism. By recycling the solvent as it comes off of the mechanism in a holding tank, the same solvent can be used repeatedly until most of the dirt has been dislodged, then the final spraying of the mechanism can be done with fresh solvent leaving it relatively clean. The entire mechanism can also be partly submerged in a tub of cleaning solvent and cleaned with a stiff bristle paint brush.

Wire Brushing: If the mechanism is totally disassembled as described in succeeding chapters, then the wire brushing of the mechanism becomes an attractive alternative to replating. Wire brushing each and every part insures the complete removal of rust and corrosion in addition to the normal grime that can be removed by solvent. Using the small power tools available, miniature wire brushes can also get into obscure corners and other hard-to-reach places in the mechanism while it is still assembled.

Carburetor Cleaner: While carburetor cleaner was used for the slides and the clock, there is a practical problem involved with using carburetor cleaner upon the entire assembled mechanism. As mentioned previously, the toxicity of the carburetor cleaner makes it very undesirable to use. Pouring it over and scrubing the mechanism with it is an unpleasant task. If the mechanism were to be disassembled and each piece dipped in the carburetor cleaner, this would accomplish very little more than could be accomplished by cleaning each piece with solvent and then wire brushing, the latter technique achieving perhaps a better result. Unless you don't mind the toxic effects of the carburetor cleaner, this procedure is not particularly recommended.

Bead Blasting: In recent years, bead blasting has become a fashionable way of cleaning the mechanism. Bead blasting is a form of sand blasting, except it uses glass beads which have less of an abrasive effect on the metal. Bead blasting can be accomplished by either blasting the partially assembled mechanism or the completely disassembled mechanism. In either case the problem of the abrasion caused by the bead blasting on the metal is still present. Bead blasting removes, to a large extent, the plating that was placed on the parts after they were manufactured. If bead blasting is done without some immediate coating such as silicon spray, the entire mechanism is highly vulnerable to rust. There is no question that bead blasting completely removes corrosion and leaves the mechanism spotless; the problem is the vulnerability to rust and corrosion, and even though the silicon spray will prevent the rusting for a certain period of time, the coatings will eventually wear away.

Lye (Aqueous Solution): While dipping the mechanism in a tank of hot lye solution will provide the desired cleaning result, the problem occurs upon drying. All of the unplated metals will turn to instant rust and the only way this can be removed is by subsequent wire brushing, replating or bead blasting. This insurmountable problem basically precludes such caustic solutions from practical use in cleaning.

In summary, if the mechanism is not going to be completely disassembled, then the preferred way to clean it is by continued washing and scrubbing with a general purpose solvent; then, after it is through drying, use a small motor tool with a wire brush to touch up those places where rust or corrosion has occurred. If the machine is disassembled, then wire brushing after cleaning with solvent is recommended unless you are a perfectionist—then replate it.

Assembling the Payout Slides and Coin Tube

Before beginning to replace the payout slides in the mechanism, the base plate and nearby areas where the slides are to be placed should be thoroughly cleaned with a fast evaporating solvent to remove any residual grease or grime which may still be left after cleaning the mechanism. While it is not necessary to lubricate

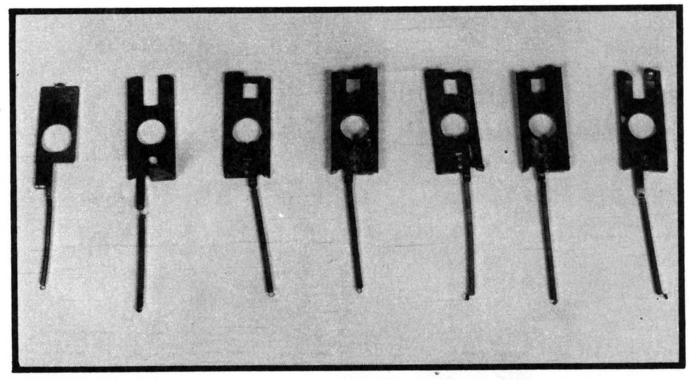


Figure 5.18

the slides when replacing them, a slight amount of powdered graphite may be rubbed across the slides in order to provide lubrication if desired. However, under no condition should you place any oil or grease on the slides.

Figure 5.18 shows the seven slides to be reinserted into the mechanism one at a time. There are four dif-

ferent types of slides illustrated in Figure 5.18; they are, from left to right, the safety slide, the bottom or master slide, the four intermediate slides, and finally the jackpot slide. The slides will be inserted into the machine in the order they appear in Figure 5.18 going from the left to the right.

Before inserting the slides into the mechanism, the

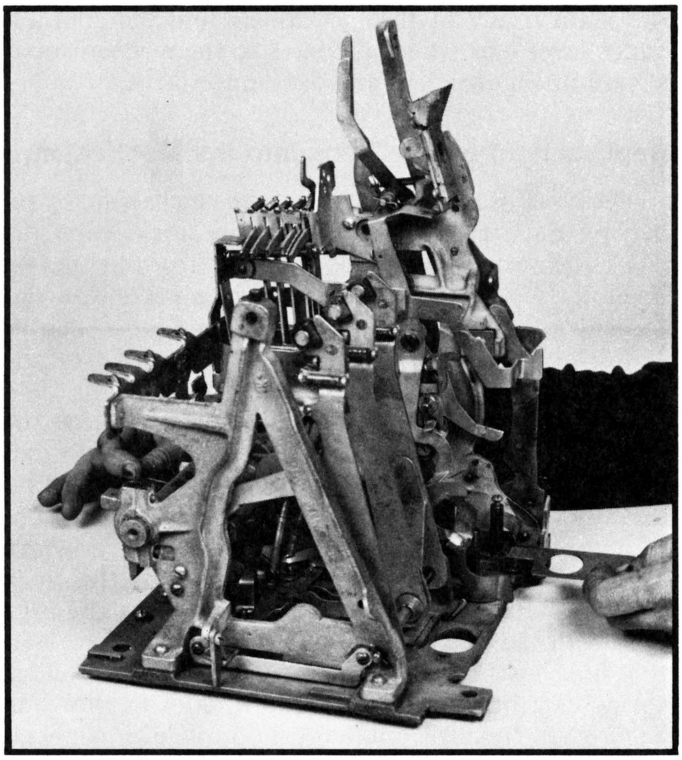


Figure 5.19

bronze springs on the intermediate and jackpot slides should be examined. First, they should not be loose; if so, the rivets holding them in place should be reset, making certain that they are level with the outside runners of the slide. The ends of the bronze springs should be formed up about ⅛" as it is the function of these leaf springs to prevent coins from slipping between the slides. If the formed end of the bronze spring is broken it should be replaced.

The safety slide is inserted into the machine first by grasping the end of the spring with a spring hook which has been inserted from the rear of the mechanism as shown in Figure 5.19, and pulling back on the spring with one hand while guiding the slide into its location in the mechanism with the other hand. When the slide is properly seated in its appropriate slot in the base of the mechanism, the spring is then pulled back and wrapped around the lowest hook on the bracket as shown in Figure 5.20, with the assistance of a pair of needle nose pliers. This process is then repeated with the master slide, four intermediate slides and then the top or jackpot slide. When inserting the master slide, make certain that it fits properly with the safety slide. Do not forget to connect the kicker spring if it has been removed (see Figure 5.21).

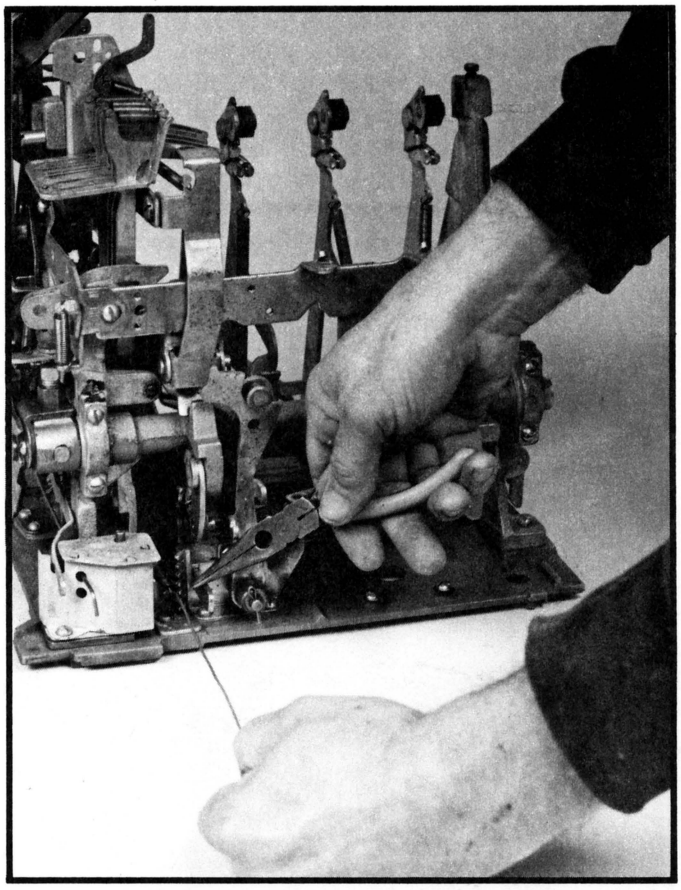


Figure 5.20

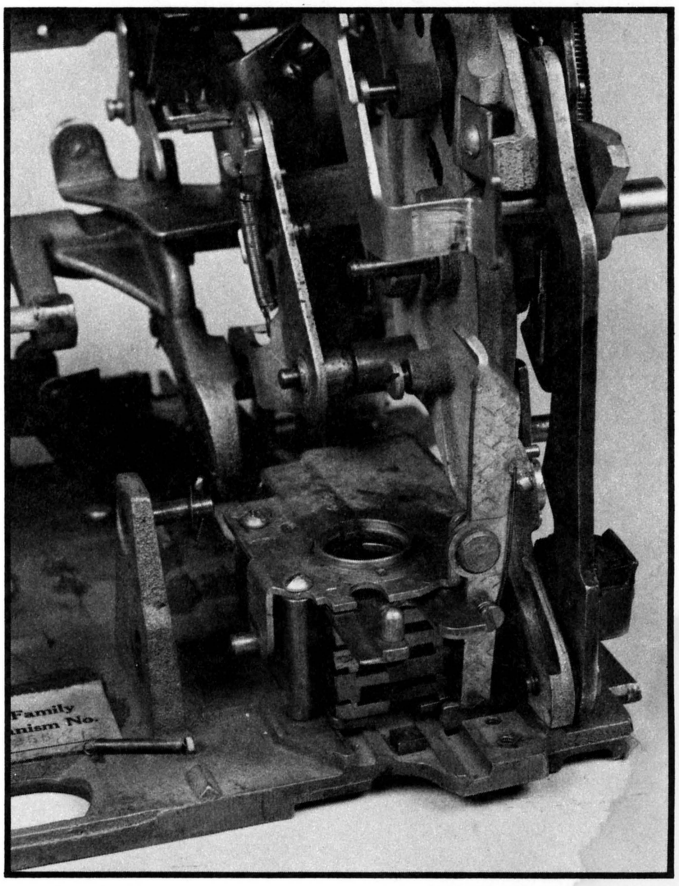


Figure 5.21

After all of the seven slides have been placed back into the mechanism, the top slide coverplate is then placed on top of these slides and secured by the four screws as shown in Figures 5.14 and 5.15. A little coaxing may be required with the slide coverplate and its accompanying slide stop lever (which is attached to it) to seat it properly as shown in Figure 5.21. The slides should now travel freely between their posts. If

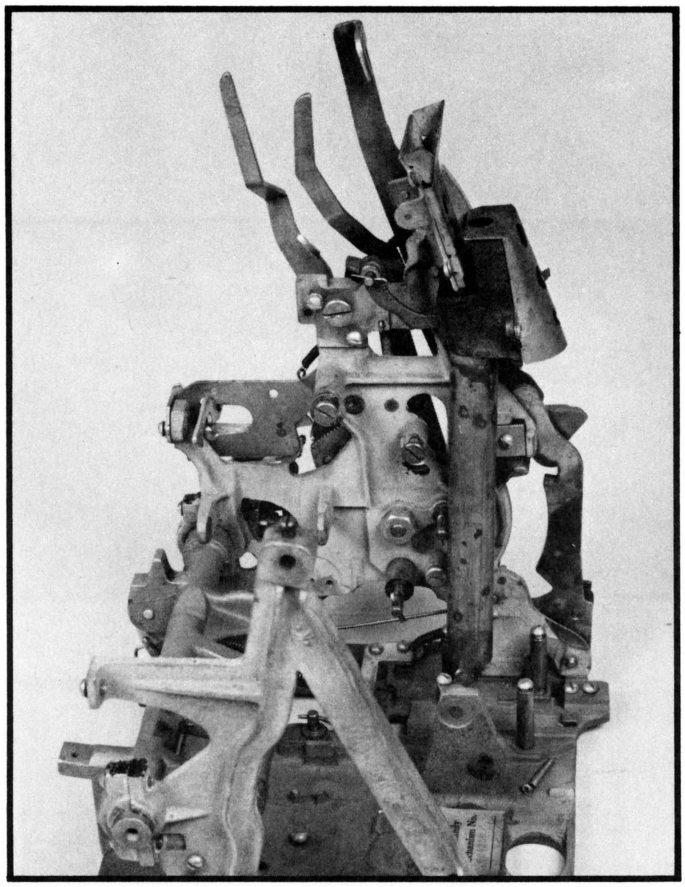


Figure 5.22

binding occurs it will be necessary to loosen the coverplate to release any pressure on the slides and determine the cause. A slide could be upside down or there may be an obstruction.

The jackpot pushbar should then be replaced as shown in Figure 5.13 by inserting the cotter pin in the shoulder stud.

The payout coin tube is inserted next as shown in Figure 5.11 while holding back the payout coin tube shutoff lever with one hand. It should be noted that the coin overflow pushlever must also be inserted simultaneously into the top slot of the coin tube as shown in Figure 5.22. The coin tube is then screwed to the main frame of the mechanism and the coin advance lever bar is fastened back to the mechanism as shown in Figures 5.10 and 5.9 respectively.

Replacement of the Clock into the Mechanism

The clock is placed back into the mechanism by reversing the steps for removing the clock. First the clock is inserted into the mechanism from behind by carefully worming it into its proper place. Do not force the clock into position. Remember — it can be stationed in its place since it was removed from its place. Just have a little patience.

After the clock has been positioned such that the two holes in its base are lined up with the two rear holes in the mechanism base, the two screws are inserted loosely, and the clock held in place. Next, connect the timing lever link to the clock as shown in Figure 5.4. It may be necessary to rotate the clock manually during this operation in order to align the post with the hole in the timing lever link arm. After this link has been connected to the clock, the clock spring can then be replaced on the clock as shown in Figure 5.3. Next, install the reel timing lever connecting link as shown in Figure 5.2 to the other post on the main arm of the clock. It may be necessary to again wind the clock such that its post and the hole in link meet properly for easy installation. After this last link has been connected the mechanism should be partially cycled such that the two inner screws mounting the clock are accessible and can be installed as shown in Figure 5.1. These screws should then be tightened firmly, and then the two rear screws can be tightened. After installation, the clock mechanism should be cycled several times by cycling the machine to insure proper operation of the clock.

6 Disassembly of the Operating Mechanism

Introduction

Thus far, various levels of machine disassembly have been described in order to accomplish *general* lubrication and cleaning. There are many reasons, however, which justify the complete disassembly of the mechanism.

First of all, the only *thorough* way to clean and lubricate a machine is piece by piece. It not only allows detailed inspection of *all* the parts but provides easier examination of potential operating deficiencies of the various mechanism components.

The criteria for lubrication is a function of time and use. In a casino environment, it is normal procedure to completely overhaul the mechanism when it begins to "act up", rather than attempt to solve only the immediate problems. In a home use environment where wear and tear is not the issue, the hardening of the lubricants is usually the more frequent problem. The requirement for home use is that the machine is, at any point in time, properly lubricated so that periodic touch-up lubrication will keep the older lubricants active.

In spite of all considerations, it is reasonable to assume that a machine which has been retired from use (either casino or route) is usually in need of complete overhaul and was replaced with a newer machine when its turn for excessive maintenance was due.

Needless to say, there are exceptions, but as a collector there is no substitute for placing the machine in flawless operating condition. Then, with minimal maintenance, it can be kept in perfect operating condition almost indefinitely. There is nothing more disappointing than demonstrating a machine and having it malfunction because it was never really placed in *proper* working condition. The extra work required to completely overhaul the mechanism is time well spent.

This chapter begins with the mechanism disassembled to the point described in Chapter 5 where the clock, coin tube assembly, and payout slides have been removed. There are three access positions to the mechanism for the purpose of dismantling it. The accesses are from the front (inside the frame), from the rear of the frame and from the right-hand side of the frame. The succeeding sections will discuss, in sequence, the disassembly of the mechanism as performed in each of the three positions.

The disassembly presented here is limited to the removal of working parts. The removal of such parts as shoulder studs, posts, guides, and brackets are not presented since these parts are normally left on the frame during a typical overhaul unless replacement is necessary. These parts could be removed for cosmetic reasons if thorough cleaning and plating is being considered. The side frames of the mechanism are left mounted to the base during the overhaul procedures since it is undesirable to break the "seal". However, the sides are easily removed by unscrewing their appropriate screws holding them to the base.

When possible, replace the screws in the threaded holes that they were removed from, and put the nuts on the bolts from which they were removed. This process greatly simplifies keeping track of which screw or nut went exactly where when it comes to reassembly. When possible, springs should be left fastened to the piece to which they have been attached in order to simplify proper spring identification with its mating part. Large quantities of assorted cotter pins are available at a very inexpensive price at hardware stores. The disassembly process should not be hampered by trying to save the cotter pins.

While there are many ways to disassemble the mechanism, the method presented here provides a relatively simple and straight forward procedure. Disassembly is important since the reassembly of the mechanism is basically the reverse process. By following the disassembly procedure described here, one will familiarize oneself with the parts and where they go, which will be of great assistance in the reassembly of the mechanism. In addition, certain assemblies and parts can only be removed after certain other parts and assemblies have been removed, and conversely, during assembly.

Disassembly of the Mechanism from Inside the Frame

Figure 6.1 shows the removal of the three reel stop

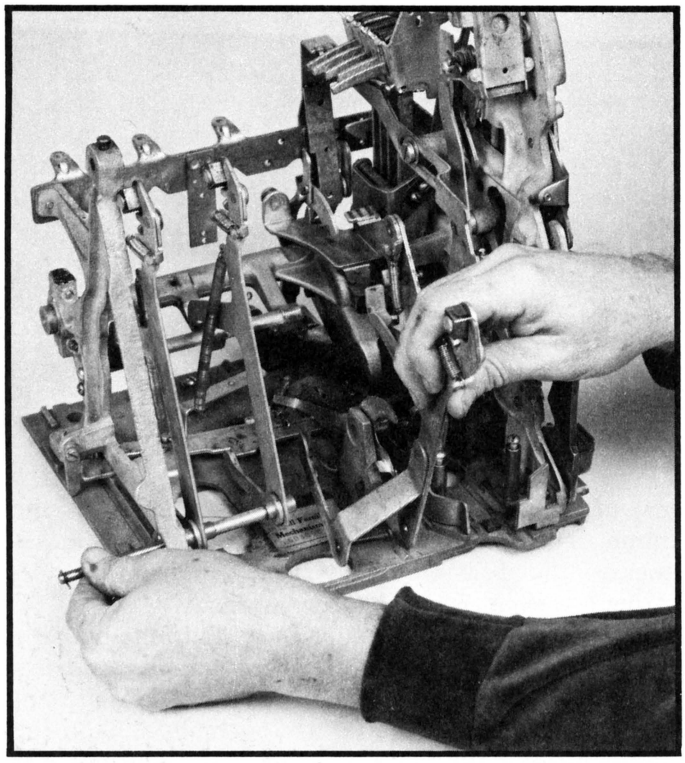


Figure 6.1

levers from the frame. This is accomplished by first removing the reel stop lever shaft which is secured by two pins, one at each end. By sliding this shaft out of the mechanism as shown in Figure 6.1, the three reel stop levers can then be removed. It is important to thoroughly clean the reel stop lever blocks located at the end of the levers in order to permit freedom of rotation of the block as well as the small extension arm which is spring loaded.

Figure 6.2 shows the removal of the fan stop lever. Removal is accomplished by unscrewing the shoulder screw and removing the spring from the fan stop lever. Once the lever has been removed, the shoulder screw should be screwed back into the base of the mechanism as a method of preventing loss.

Figure 6.3 shows the removal of the jackpot push-

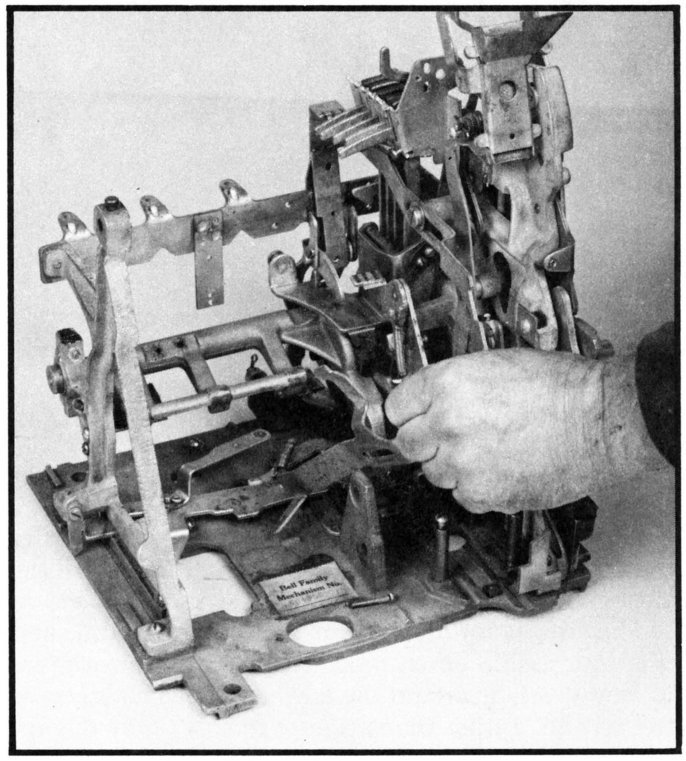


Figure 6.3

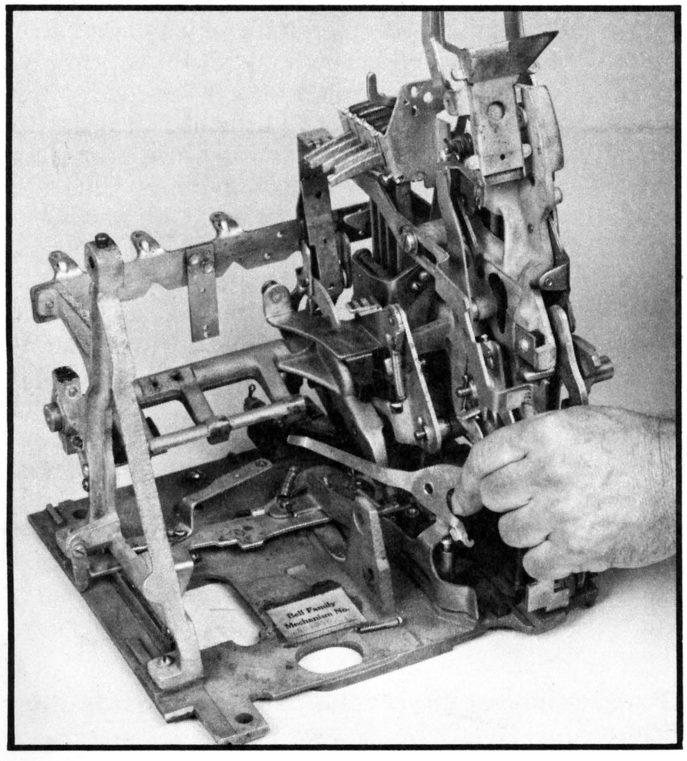


Figure 6.2

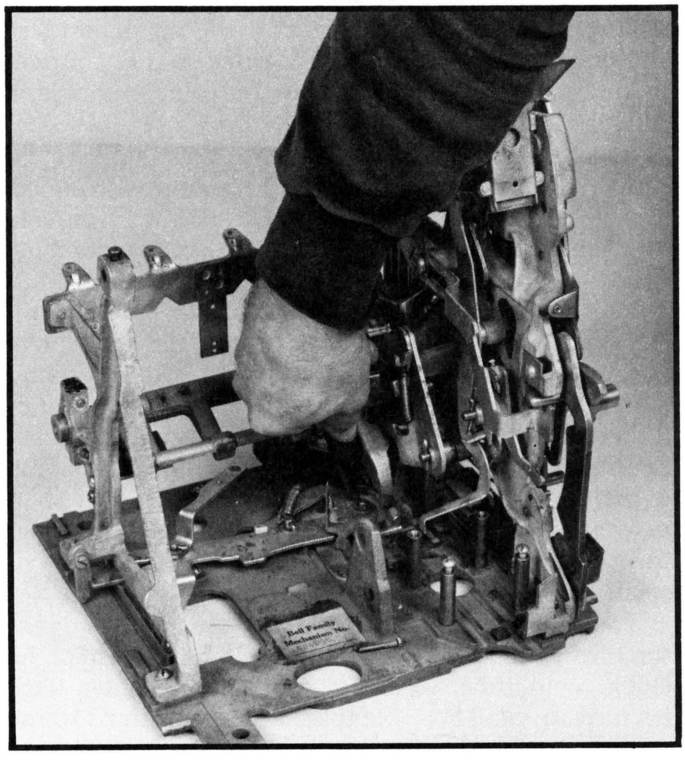


Figure 6.4

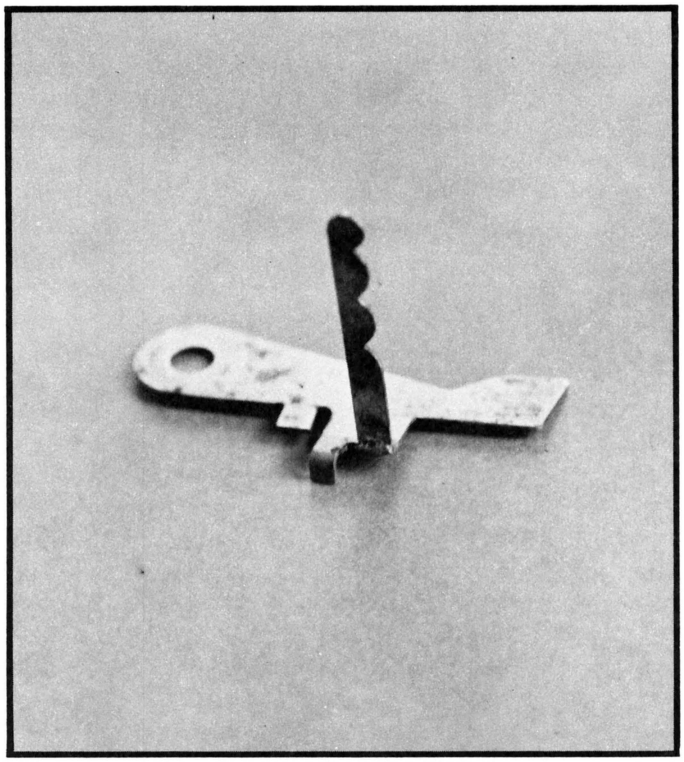


Figure 6.5

bar from the machine. This is accomplished by removing the cotter pin which holds the jackpot pushbar to the reel stop timing lever. As a convenience, the washer should be put back on the reel stop timing lever and secured with the cotter pin to prevent loss.

Figure 6.4 shows the removal of the cotter pin which permits removal of the payout slide safety lock shown in Figure 6.5. This payout slide safety lock is an anti-cheat device which prevents tampering with the slides. This part is usually not found on earlier machines and is frequently missing on later machines.

Figure 6.6 shows the removal of the reel stop timing lever from the same post. It should be noted that there are washers both above and below this lever, and they should be saved on the post in their respective positions for reassembly. Figure 6.7 shows the removal of

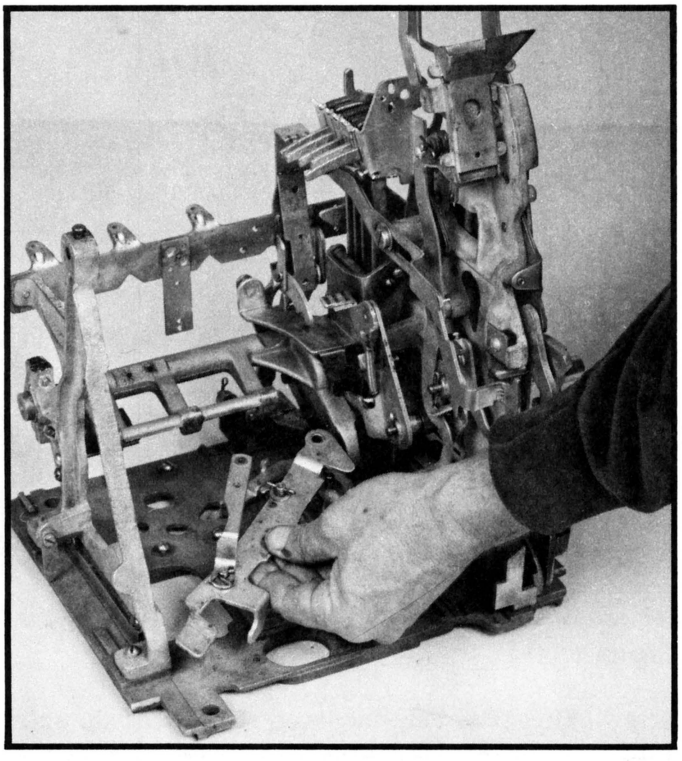


Figure 6.6

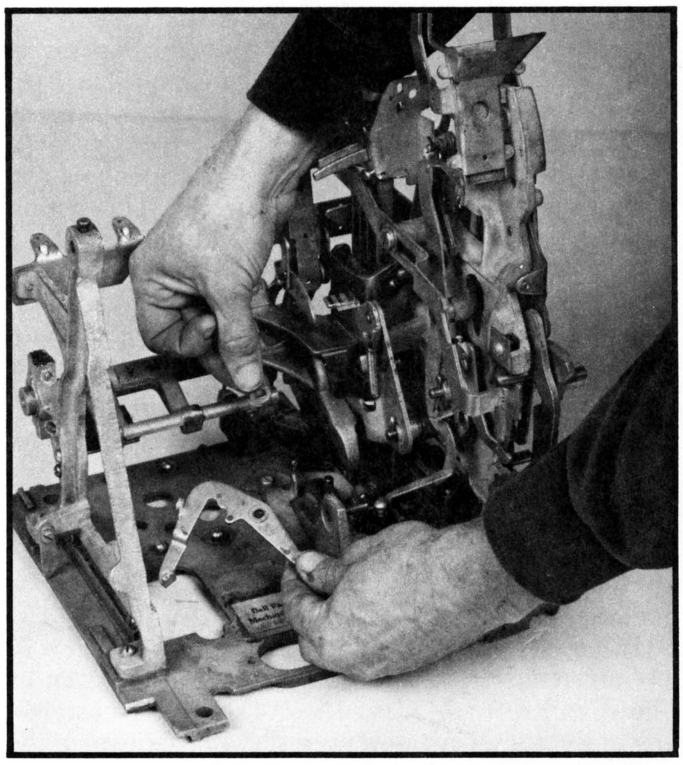


Figure 6.7

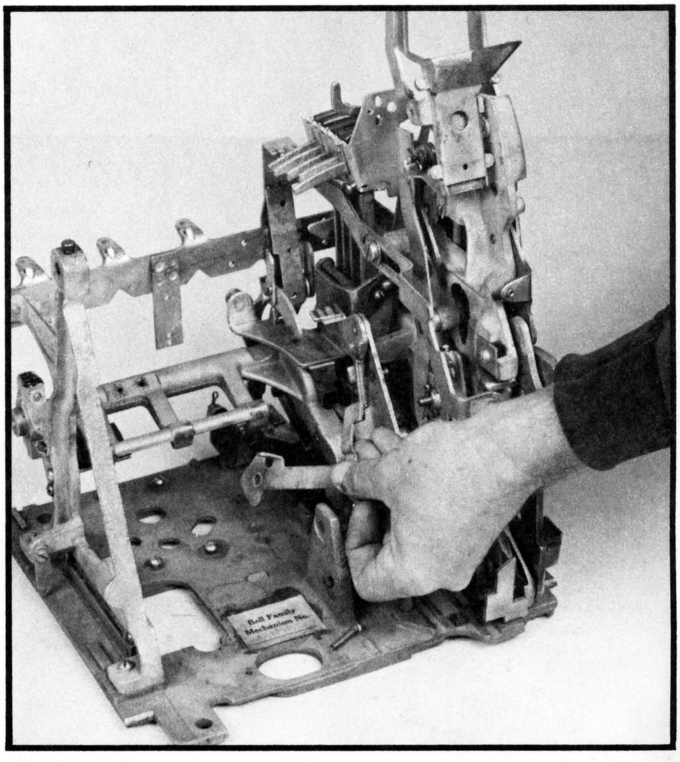


Figure 6.8

the payout slide stop lever, which is the last part to be removed from this post.

Figure 6.8 shows the removal of the payout slide manual stop lever after having unscrewed its shoulder screw. This stop lever is usually missing on most mechanisms and is used only for certain maintenance operations. It is useless during the operation of the mechanism and its utility is very slight during maintenance, rendering it a nonessential part.

Figure 6.9 shows the removal of the reel operating lever assembly (kicker) after the cotter pin has been removed. The flat plate of metal at the end of the kicker is subject to excessive wear, since it is this piece of metal which comes into contact with the three reel discs each time the machine is cycled. This action causes a wearing of three grooves in this plate and is a potential cause of serious malfunctioning of the mechanism. If excessive wear is noted on this piece, the plate should either be replaced or built up with welding rod to its original thickness. On some earlier machines this part had a different configuration (see Appendix A.1).

Figure 6.10 shows the removal of one of the shoulder screws holding the award check release pushbar. The other shoulder screw is located at the other end of the bar. Figure 6.11 shows the removal of the pushbar itself. These shoulder screws should be replaced to prevent loss.

Figure 6.12 shows removal of the shoulder screw to permit removal of the coin tube shutoff lever as shown in Figure 6.13. Figure 6.14 shows the unscrewing of the shoulder screw necessary for removal of the coin tube shutoff detection lever which pivots on this screw. After removing the lever, replace the shoulder screws to prevent their loss.

Figure 6.15 shows the coin tube shutoff lever latch

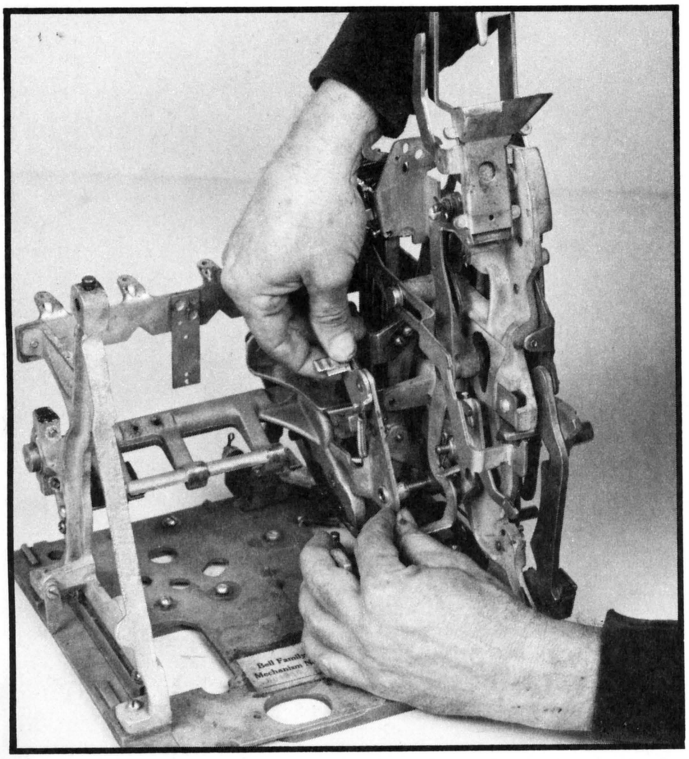


Figure 6.9

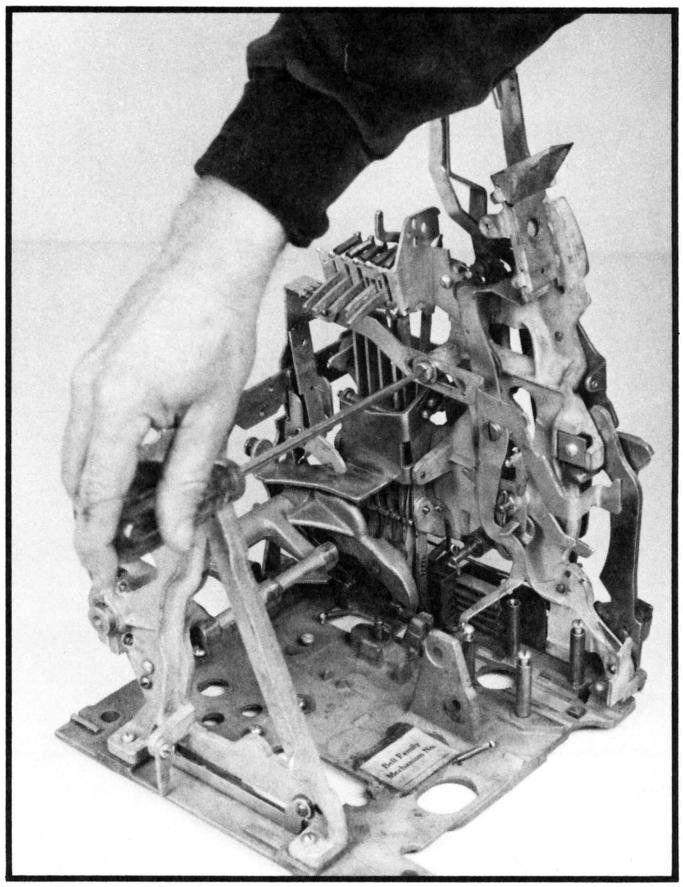


Figure 6.10

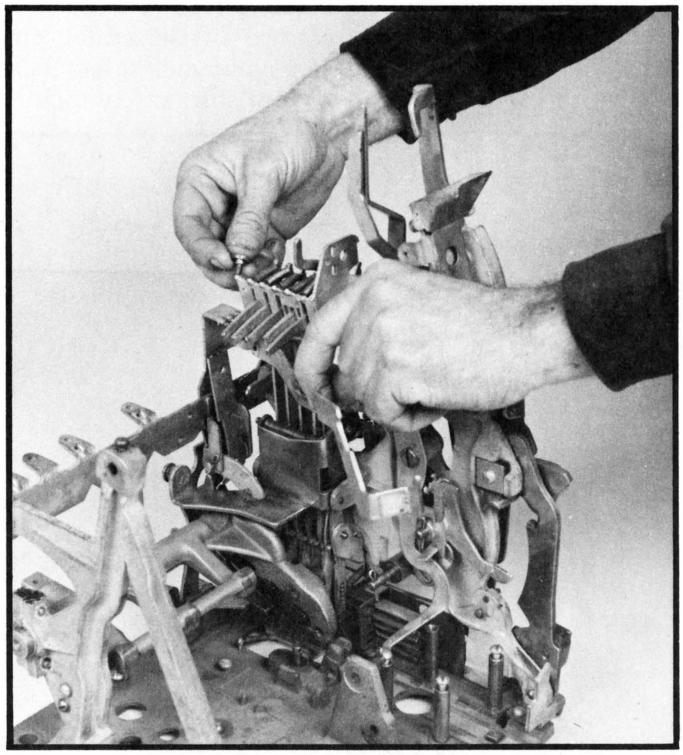


Figure 6.11

assembly after the cotter pin retaining it on the post has been removed. This assembly consists of two levers, namely the latch lever and the activator lever, along with the spring linking the two together. The relative positions of these levers with respect to each other and the spring should be noted since it is very important to replace them in exactly the proper posi-

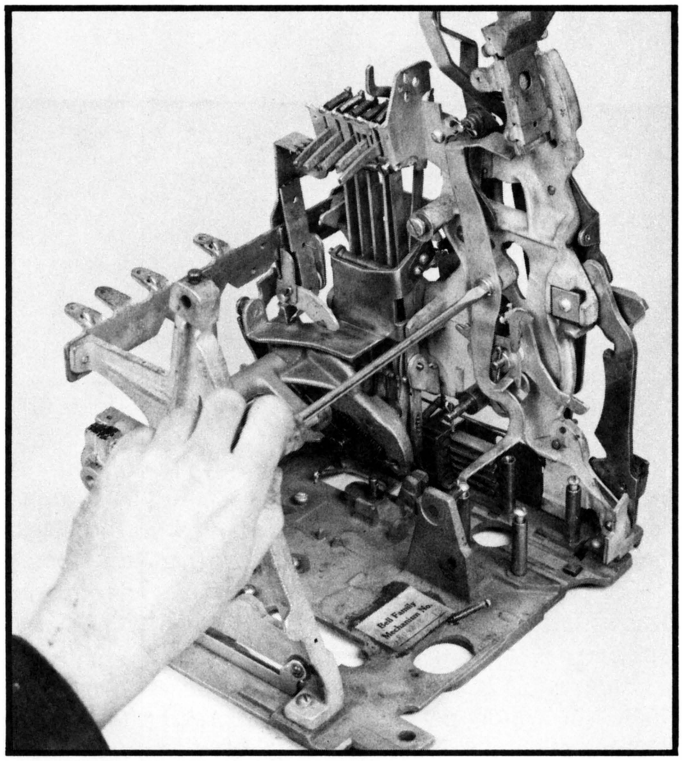


Figure 6.12

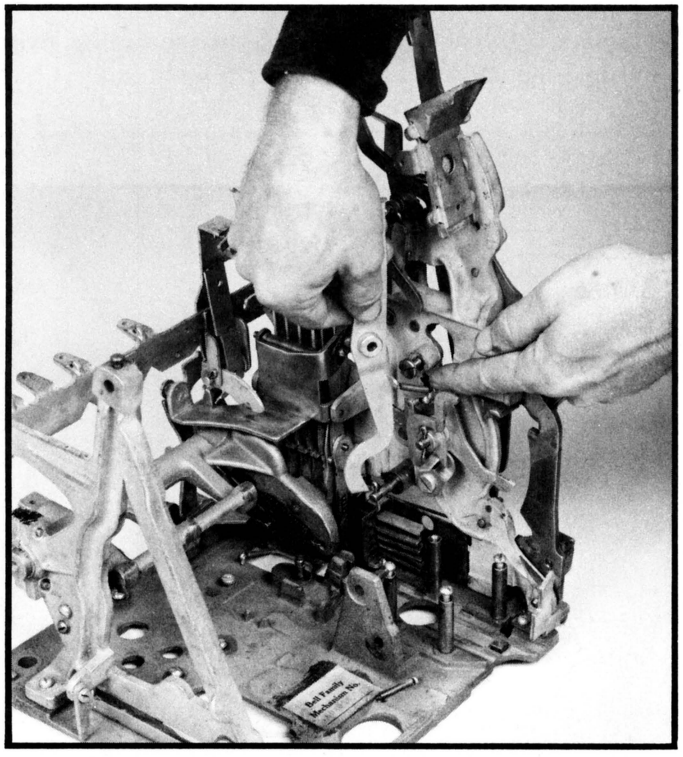


Figure 6.13

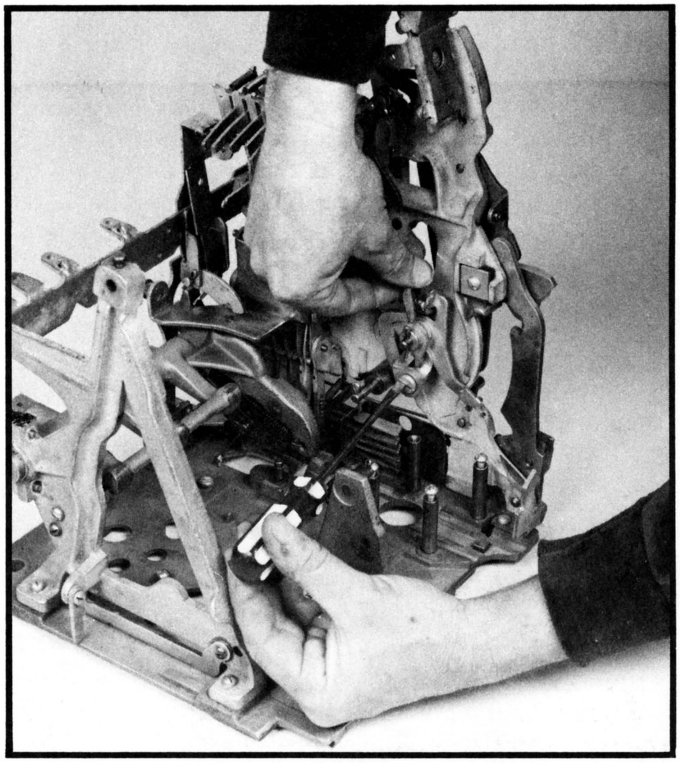


Figure 6.14

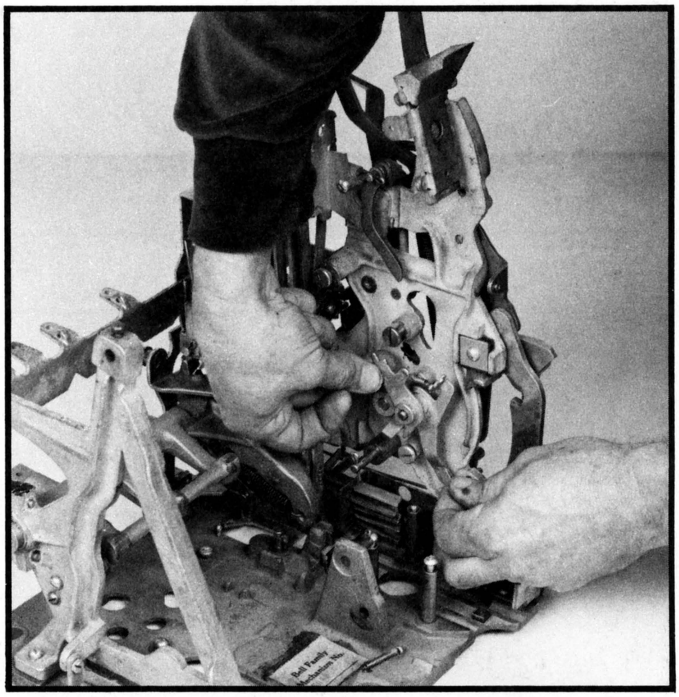


Figure 6.15

tion with respect to each other. The proper relative positioning of these levers is shown in Figure 6.12.

The four coin tube shutoff levers just removed, control the filling of coins into the jackpot as a function of how many coins are remaining in the payout tube when a jackpot is achieved. For home use this is a relatively unimportant function and is not considered an essential part of the machine. These shut off parts are subject to malfunction if they are not kept absolutely

clean and free from dust and grime. If their use is desirable, then they should be thoroughly cleaned; and it should be verified that all the parts are working freely. If the parts do not move freely it is easy for the payout shutoff lever to become permanently placed over the coin tube and thus divert all coins into the jackpot which eventually leads to the emptying of the coin tube leaving no coins for payout situations.

Removal of Components from the Rear of the Mechanism

Figure 6.16 shows the removal of the disc stop lever assembly. Removal is accomplished by first removing the cotter pin from the pin and then withdrawing it

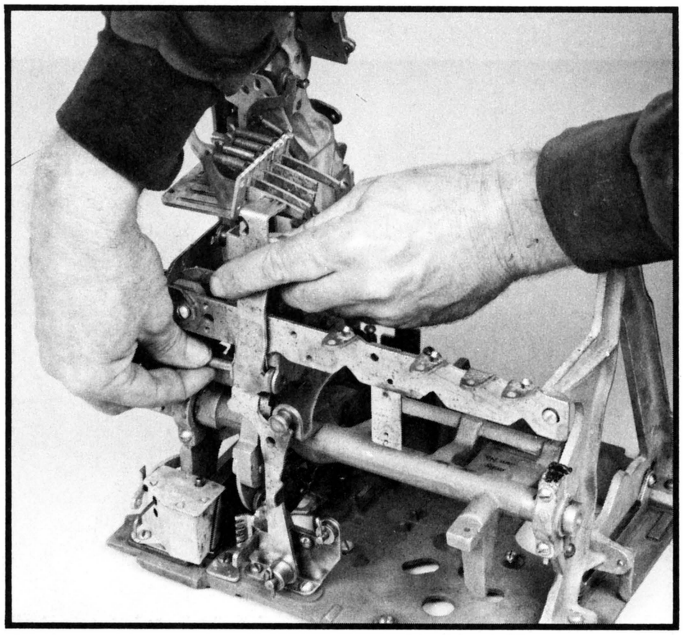


Figure 6.16

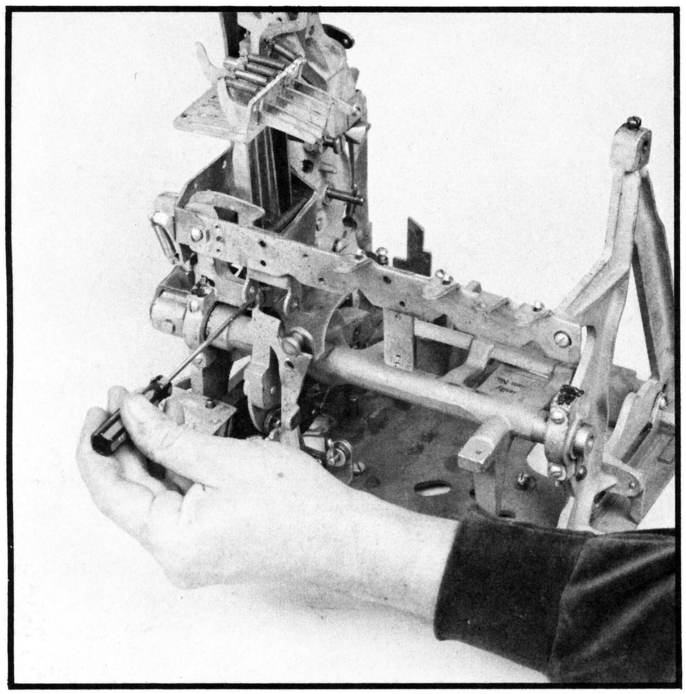


Figure 6.17

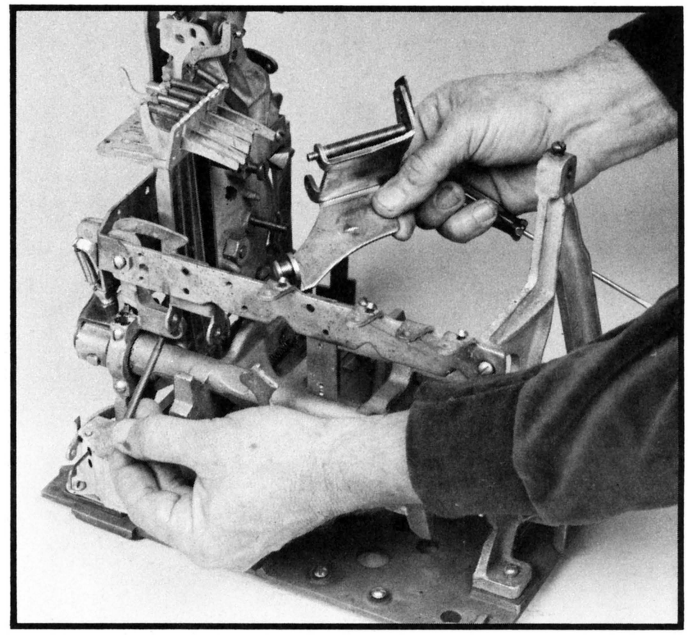


Figure 6.18

from the frame. In this mechanism there are actually two levers associated with this assembly, the inner lever being the actual disc stop lever, and the larger being the sensor for the award token payout, being called the award token release lever. After removal, this assembly should be kept together with its pin and spring.

Figures 6.17 and 6.18 show the removal of a three inch pin which permits the removal of the vertical payout pushback lever assembly. After removal of the assembly it is recommended that the pin be reinserted into the assembly until the machine has been reassembled.

Figure 6.19 shows the removal of the timing lever and hub assembly after the cotter pin retaining it has been removed.

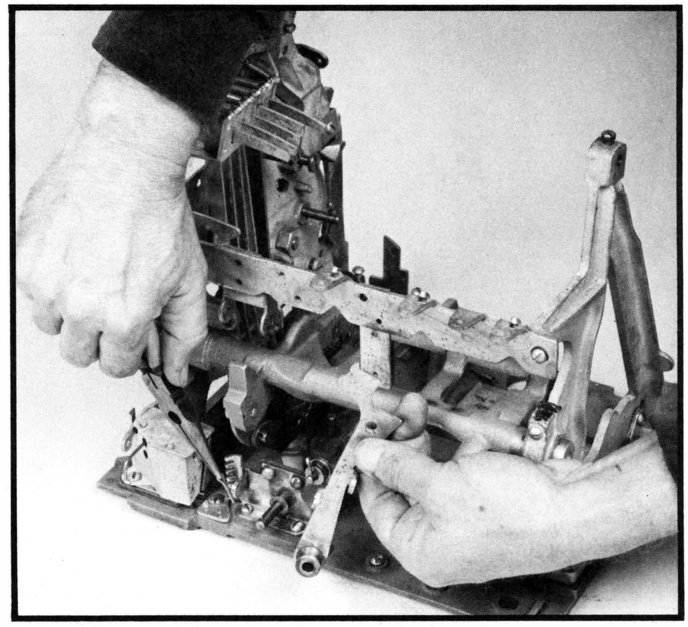


Figure 6.19

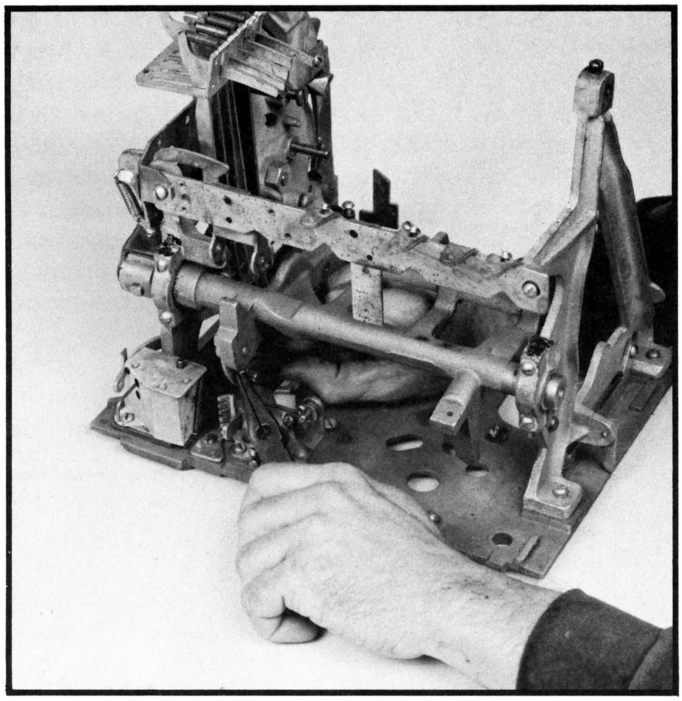


Figure 6.20

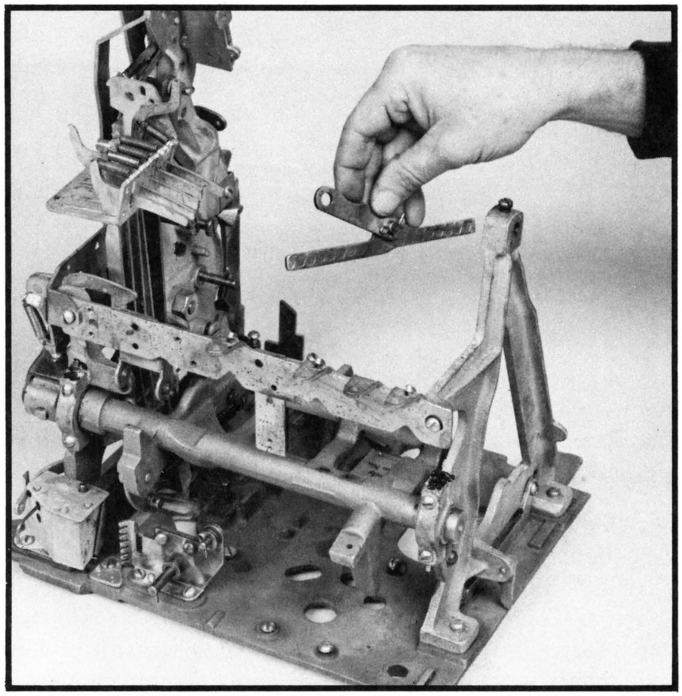


Figure 6.21

Figure 6.20 and 6.21 shows the removal of the payout slide pushbar and the payout slide pushbar linkage arm. The cotter pin is first removed which secures the payout slide pushbar assembly to the main operating fork. With a little coaxing it can be freed from the fork and slid out as shown. Note that the payout slide pushbar is removed with its linkage bar. If these two pieces are to be separated for cleaning, their relative positions with respect to each other should be noted such that when they are reassembled they will go back together exactly as when taken apart.

Figures 6.22 and 6.23 show the removal of the operating fork assembly This is accomplished by first removing the four screws holding the two bearing caps at each end of the fork. It should be noted that before removing these bearing caps they should be color coded or otherwise marked so that the relative top to bottom position can be retained. If they are not so marked already, a little bit of paint may be applied to both the frame and the caps so that when they are re-

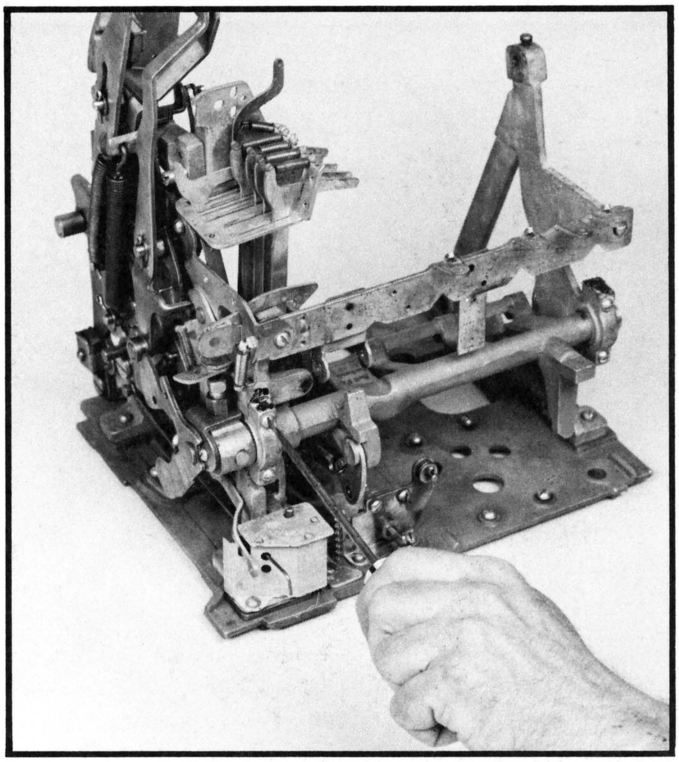


Figure 6.22

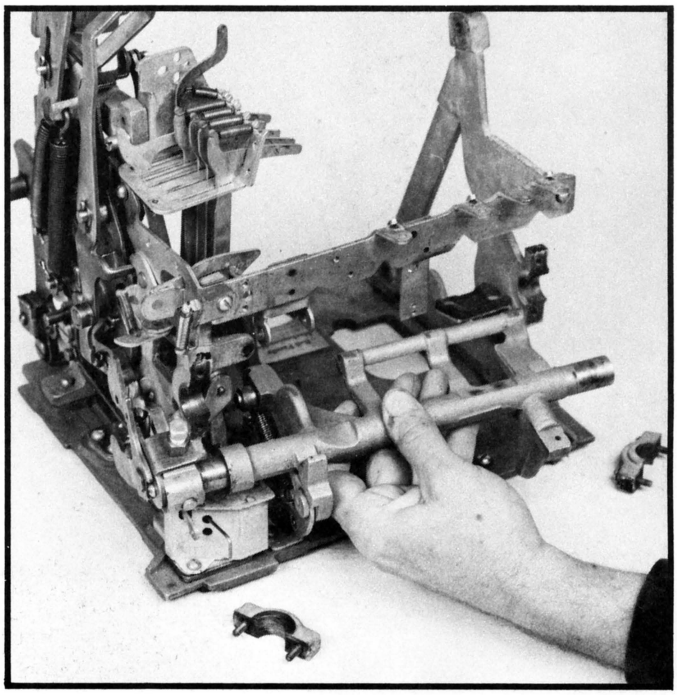


Figure 6.23

placed no confusion can exist. Another simple method is to make a light mark with a file or other sharp instrument, thus "tying" the two pieces together. After the removal of the fork, the caps and their screws should be replaced loosely to keep them in order and in place. It should be noted that part of the payout slide pushbar assembly and its springs still remains on the operating fork and may be removed if so desired for further cleaning. It was left on until this point since it is a lot easier to remove the spring with the operating fork out of the mechanism rather than to attempt to remove it while it is still in the frame.

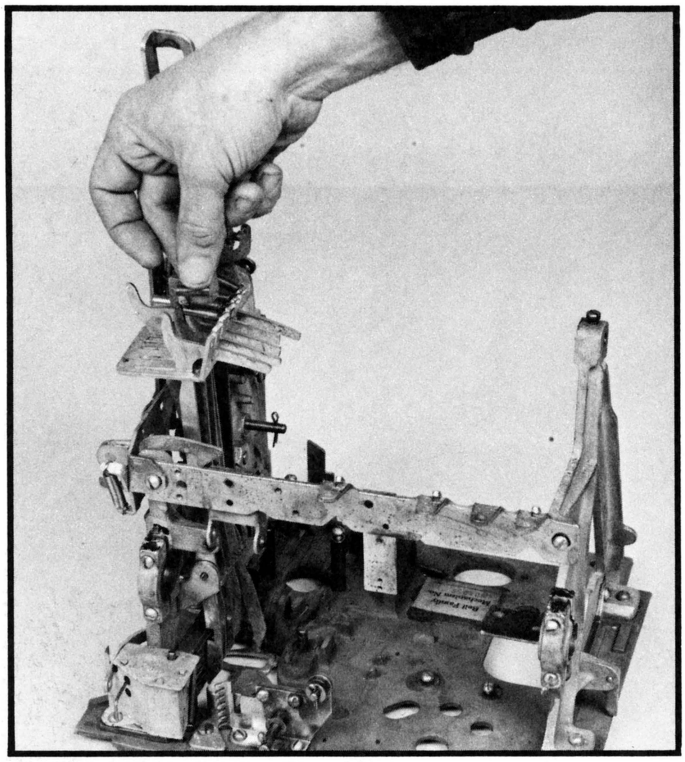


Figure 6.24

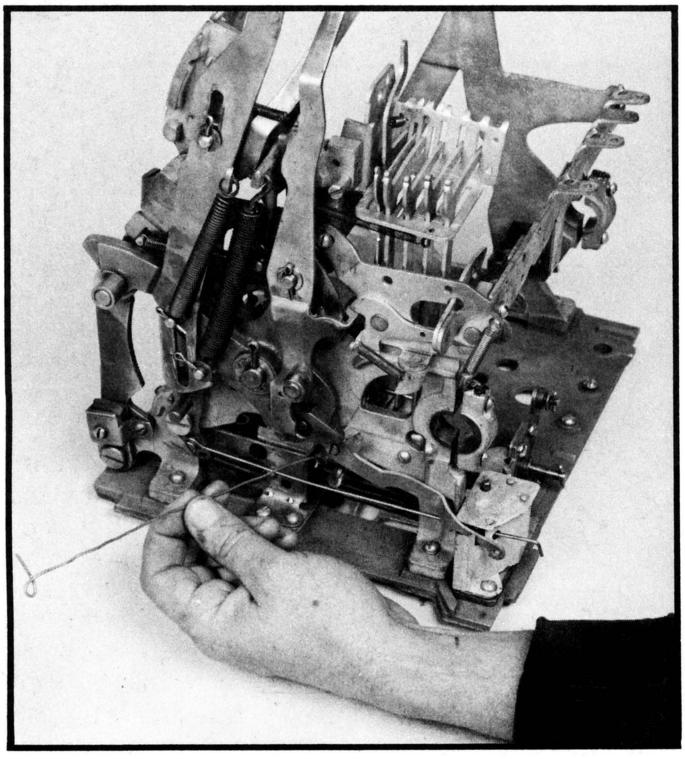


Figure 6.25

Figure 6.24 shows the removal of the vertical payout lever springs. Figure 6.25 shows the removal of an additional spring connected between the frame and the jackpot payout lever. Since this spring is somewhat concealed, it will probably be necessary to use a spring hook to fish it out.

Figure 6.26 shows the removal of the vertical payout lever shaft on which all of the vertical payout levers pivot. It should be noted that the rear of this pin is secured by a locknut which needs to be removed first before unscrewing the shaft. It is important that this lock nut also be kept with the pin and replaced when the machine is assembled since this particular pin receives an excessive amount of vibration and is subject to working itself loose, causing malfunctioning of the mechanism.

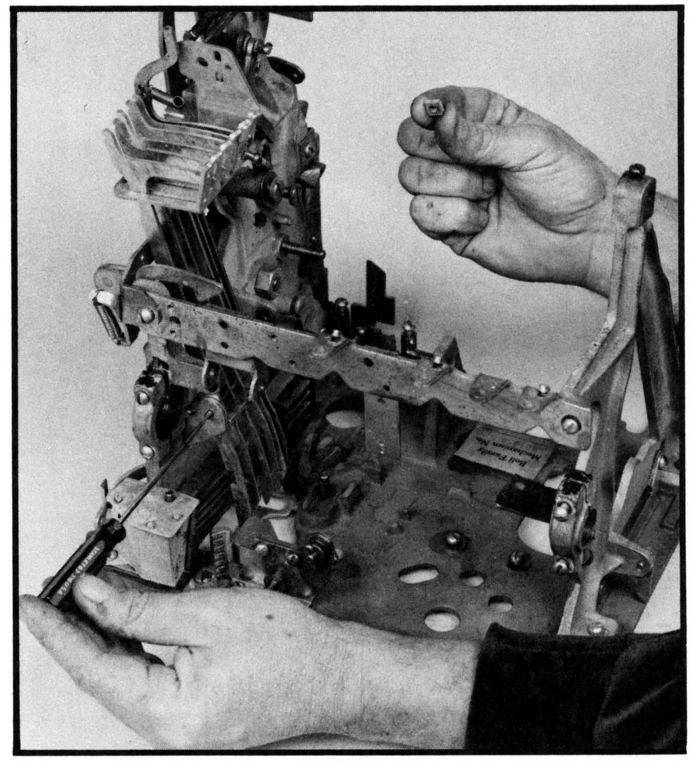


Figure 6.26

Figure 6.27 shows the vertical payout levers being removed from the base. It will be necessary to unwind the spring (if one exists) on the jackpot lever, which is still attached, in order to free it from the mechanism. The relative order of the payout levers as they are removed from the mechanism should be preserved by inserting a piece of wire through the pivot holes in each of the payout levers. Once again, as the theory of operation of the mechanism is mastered, it will be easy to identify the position where each payout lever goes.

Figure 6.28 shows the unscrewing and removing of

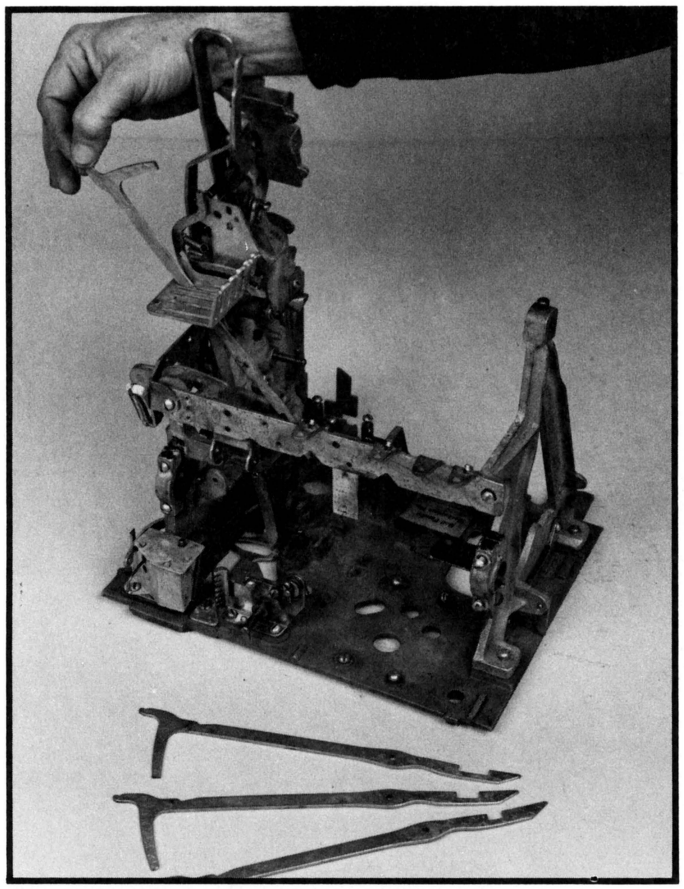


Figure 6.27

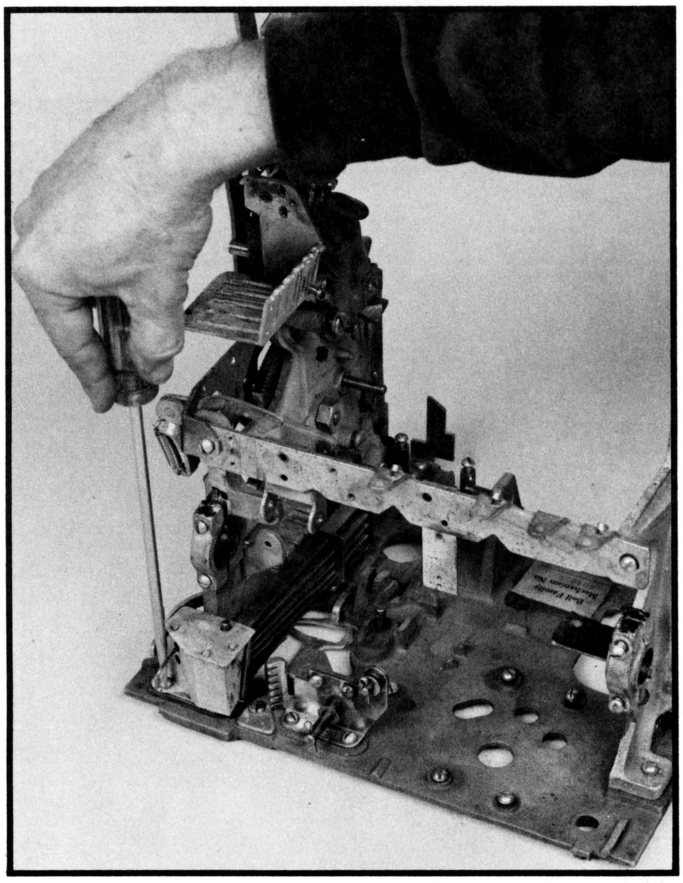


Figure 6.28

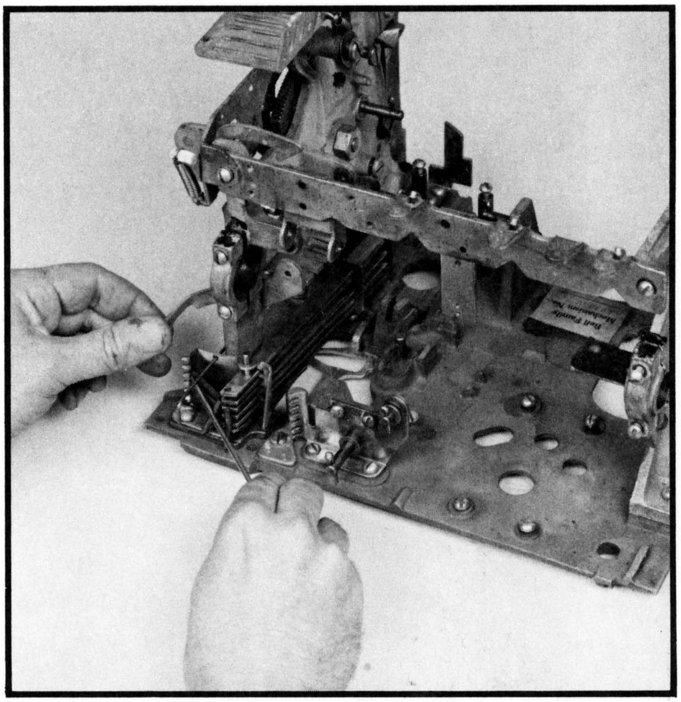


Figure 6.29

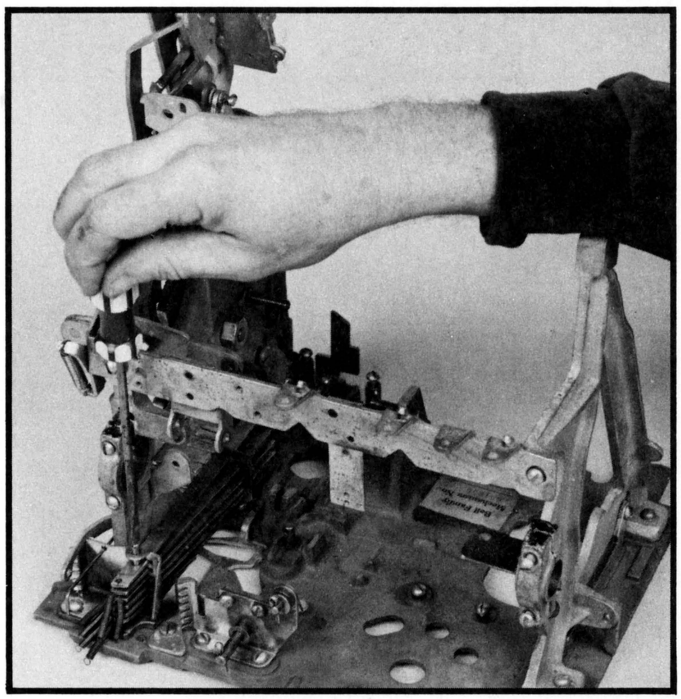


Figure 6.30

the horizontal payout lever guard cover. Figure 6.29 shows the unfastening of each of the horizontal payout lever springs from the horizontal payout lever bracket. Once all the springs have been freed, the horizontal payout lever fulcrum on which the horizontal payout levers pivot is removed as shown in Figure 6.30. This pin also has a lock nut underneath it which is accessible from the bottom of the mechanism and needs to be removed in order to enable unscrewing of this pin for removal. As before, when assembling this mechanism, this lock nut must be secured onto this pin to prevent possible loosening during operational

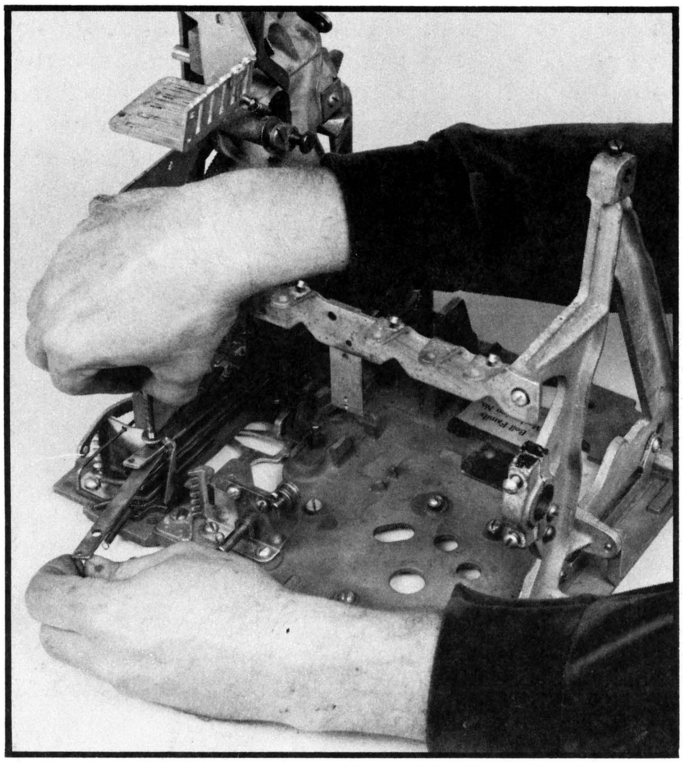


Figure 6.31

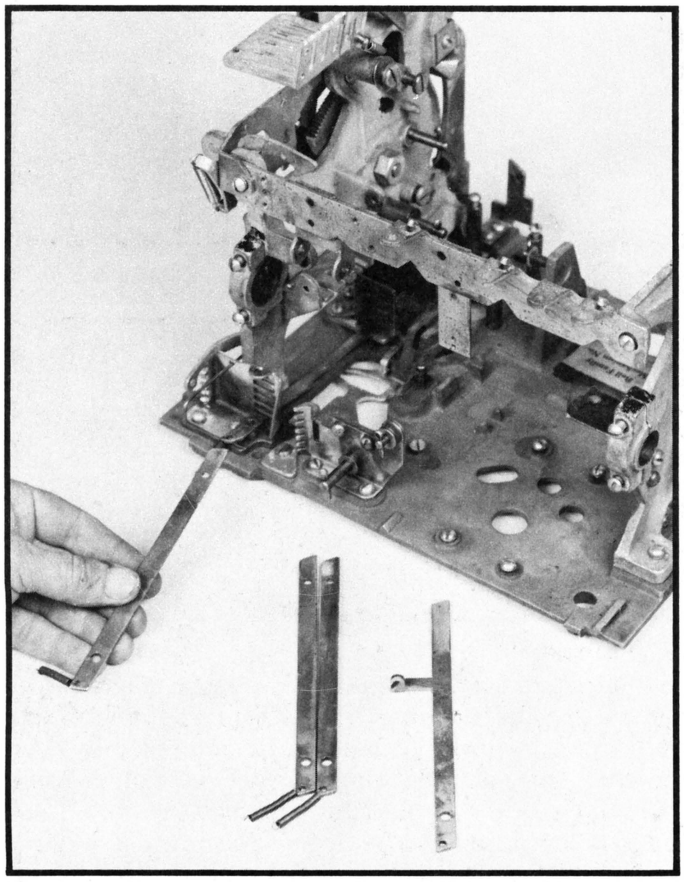


Figure 6.32

play of the mechanism.

After the fulcrum has been removed, the horizontal payout levers may be removed by pulling them backwards as shown in Figures 6.31 and 6.32. It is important to preserve the order of the payout levers as they are removed from the machine. The first lever to be removed is a special lever and corresponds to the jackpot. The spring at the end of this lever needs to be removed first to permit sliding it forward slightly and freeing it from the bracket, before it can be pulled out. The subsequent levers may all be pulled out then, one at a time, directly backward and away from the mechanism. It is recommended that a piece of wire be placed through the pivot holes of each lever to sim-

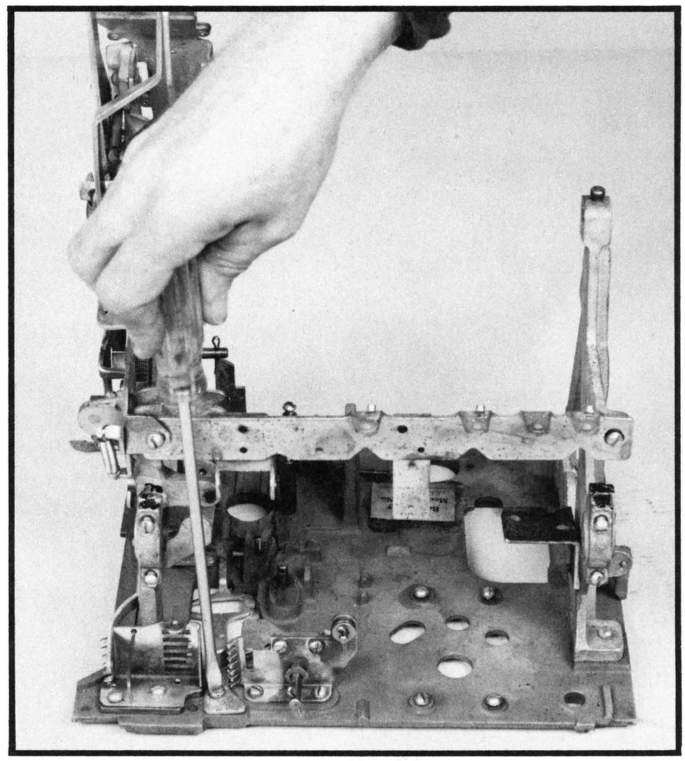


Figure 6.33

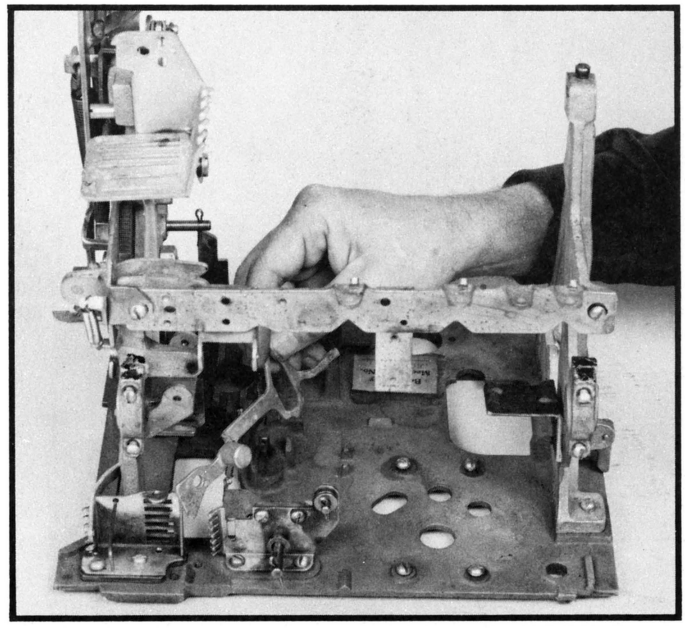


Figure 6.34

plify perserving the order and direction in which these levers were removed from the machine.

Next, the safety slide lever assembly is removed as shown in Figures 6.33 and 6.34 by removing the shoulder screw and lifting the safety slide lever away from the mechanism. Before removing the safety slide lever it will be necessary to detach the spring from the cotter pin in the base of mechanism which joined the safety slide lever. This can be accomplished by working from beneath the mechanism. Be sure to replace the shoulder screw back into the mechanism's base.

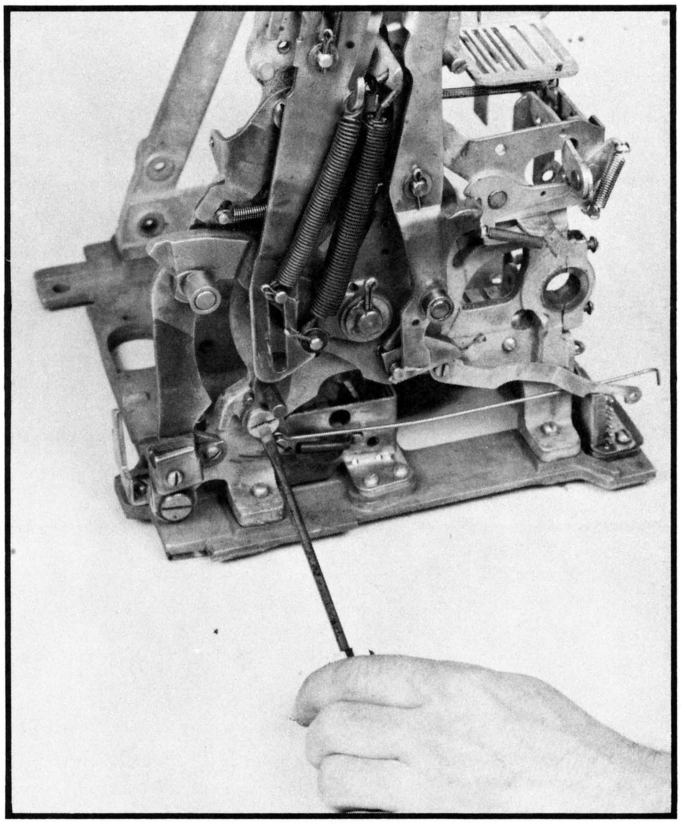


Figure 6.35

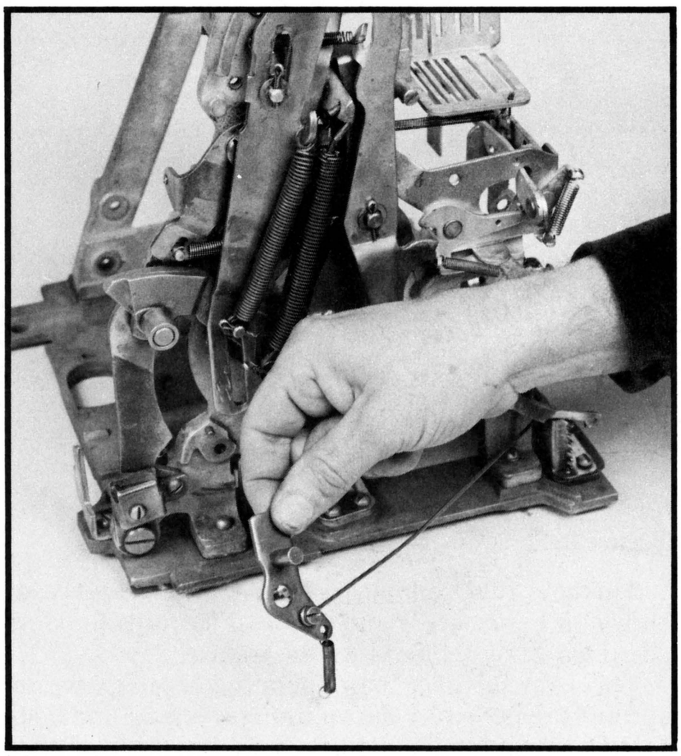


Figure 6.36

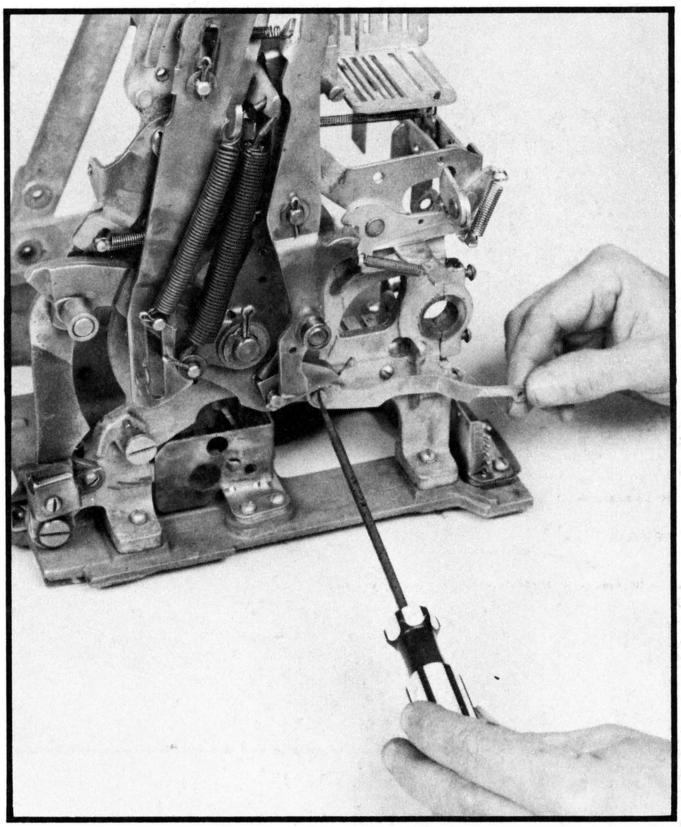


Figure 6.37

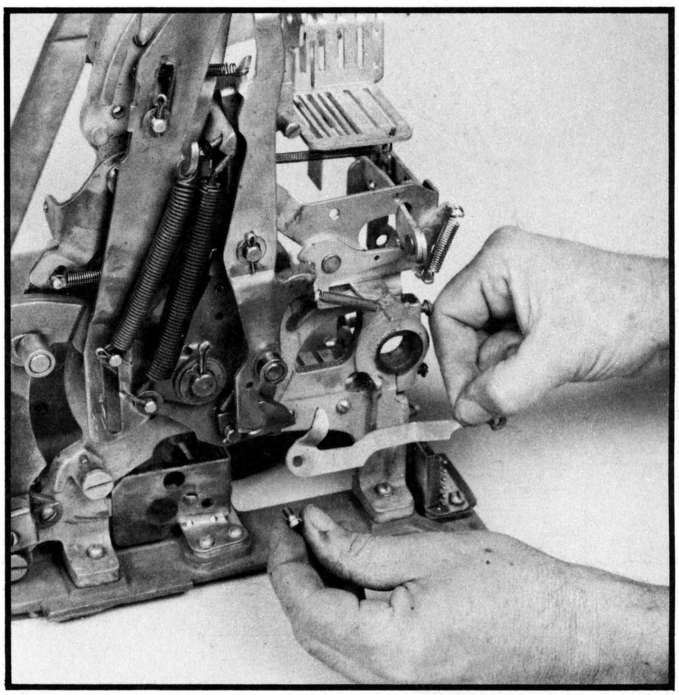


Figure 6.38

Removal of Mechanism Parts from the Right Side Frame

The main operating lever stop and pin assembly is removed as shown in Figures 6.35 and 6.36. The shoulder screw should be replaced and the wire eased out from the rear bracket.

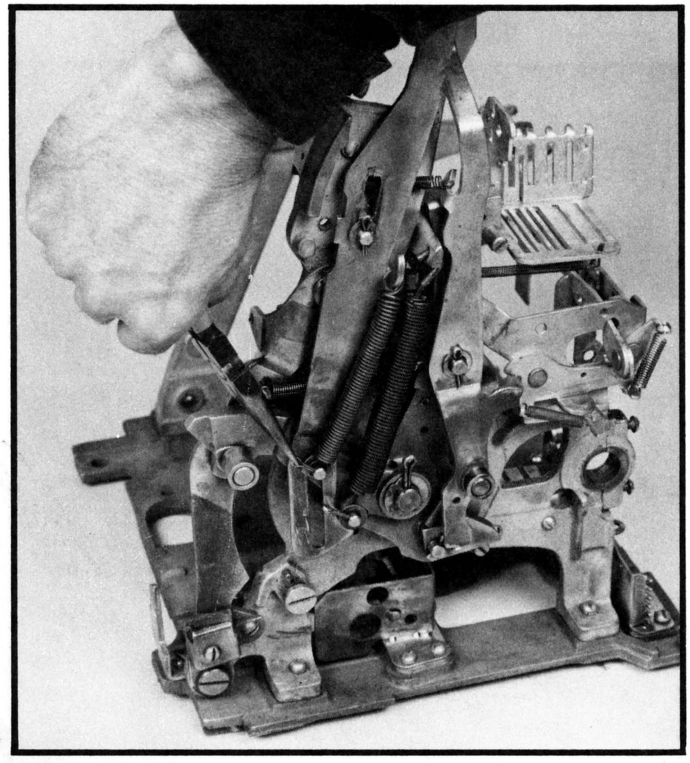


Figure 6.39

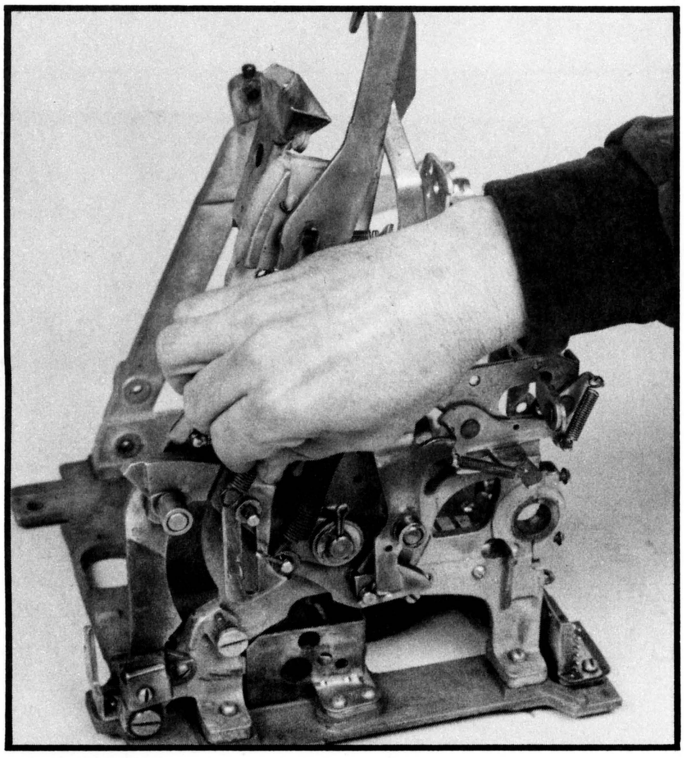


Figure 6.40

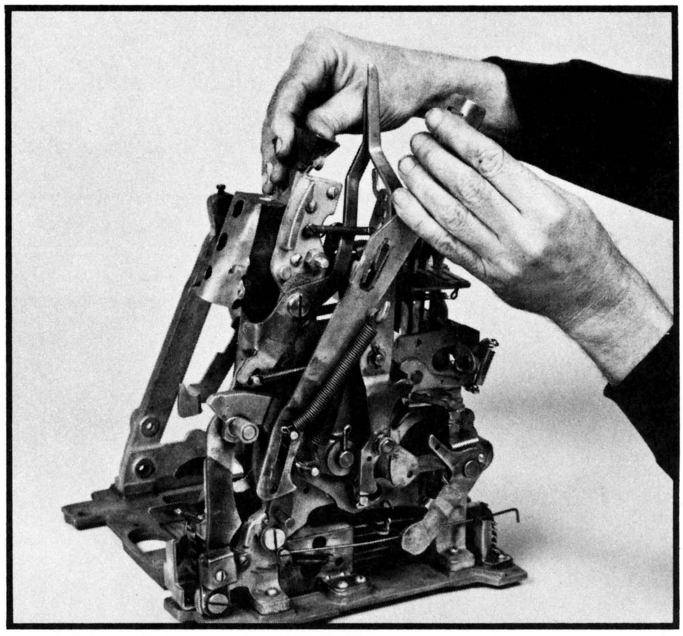


Figure 6.41

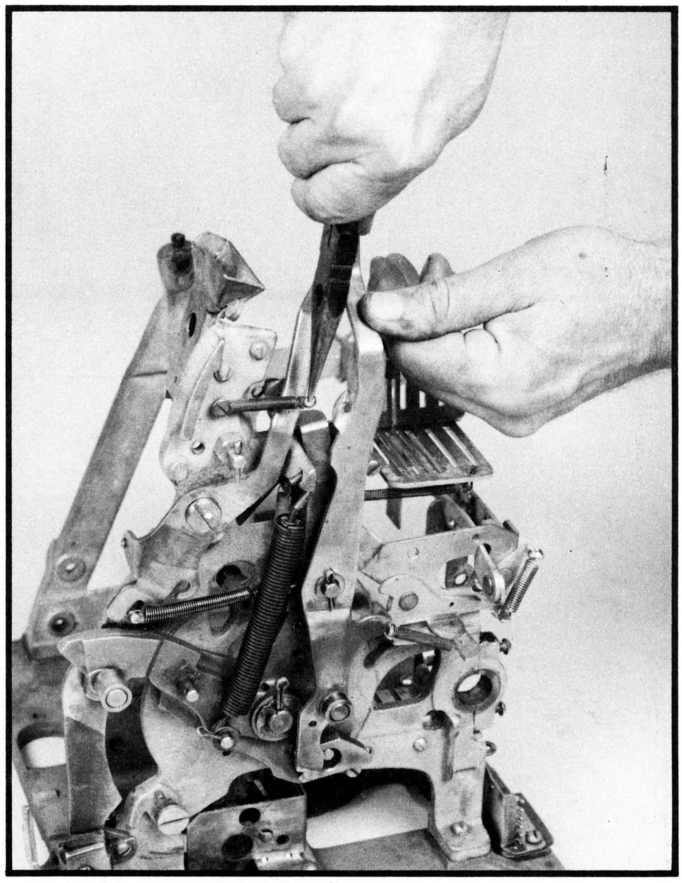


Figure 6.42

The coin tube loading arm should be removed as shown in Figures 6.37 and 6.38 and its corresponding shoulder screw replaced on the frame.

The coin advance bar operating lever extension spring is removed as shown in Figures 6.39 and 6.40, by first removing the cotter pin and washer and then slipping the end of the spring over the stud. After the

spring has been removed, the coin advance bar operating lever can be freed from the frame by removing the remaining cotter pin and washer as shown in Figure 6.41.

The check detector operating arm assembly is removed as shown in Figures 6.42 and 6.43 by first removing the extension spring, and then the cotter pin and washer, freeing the bar from the frame.

The main operating lever extension spring and hook assembly is removed as shown in Figures 6.44 and 6.45, by removing the cotter pin and washer at

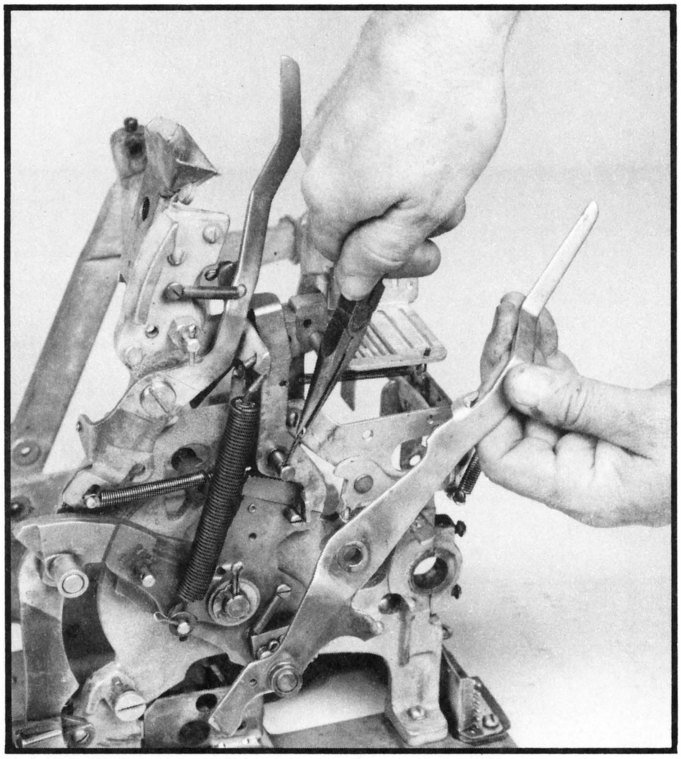


Figure 6.43

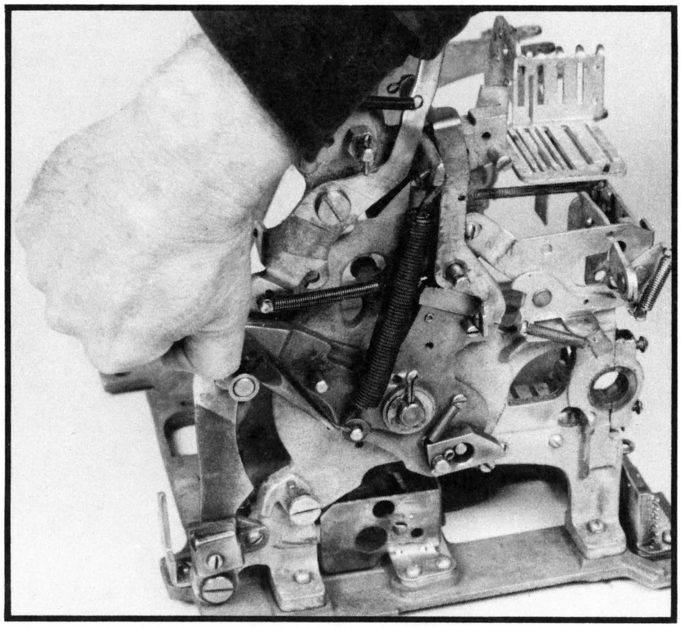


Figure 6.44

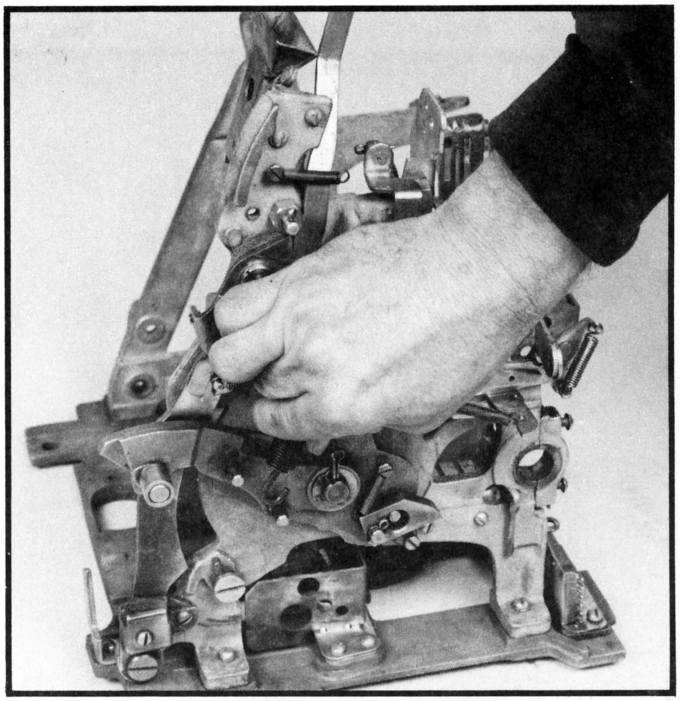


Figure 6.45

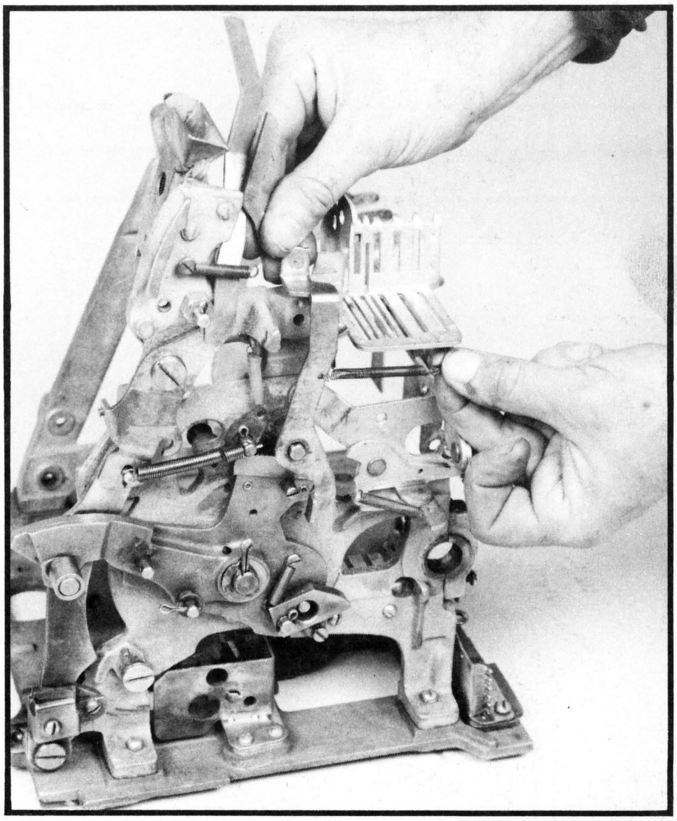


Figure 6.46

the lower end of the spring and then stretching the spring down and off the pin at the bottom. It should be noted that the hook at the other end of the spring is threaded and is adjustable so that the tension on this spring may be varied.

The coin overflow pushlever assembly can be removed from the frame, as shown in Figure 6.46, by

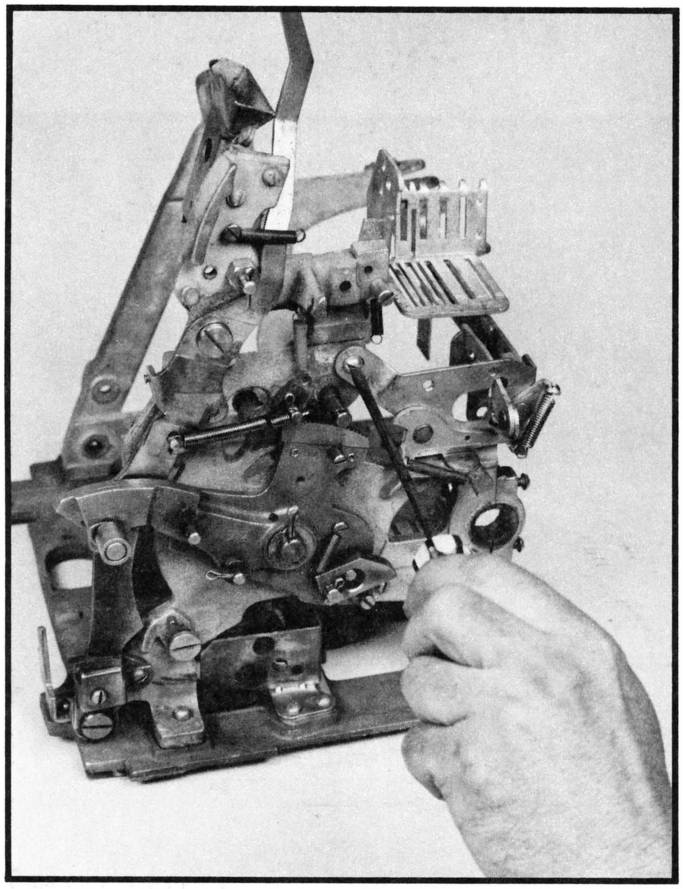


Figure 6.47

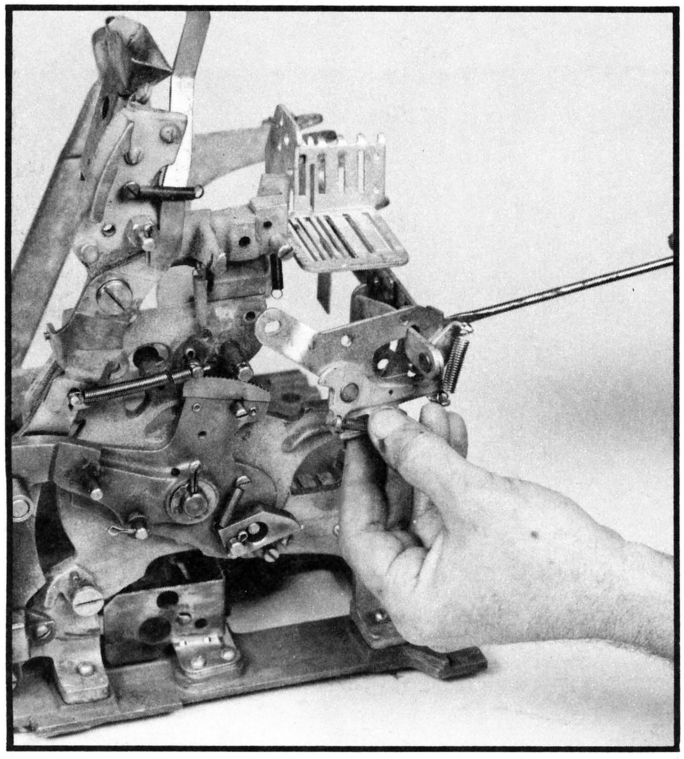


Figure 6.48

first removing the extension spring connected to it from the bracket and then lifting the assembly away from the machine. The small crescent shaped arm attached to it is called the rake.

The anti-check payout base assembly can be removed as shown in Figure 6.47 and 6.48 by first removing the two screws shown and then pulling away

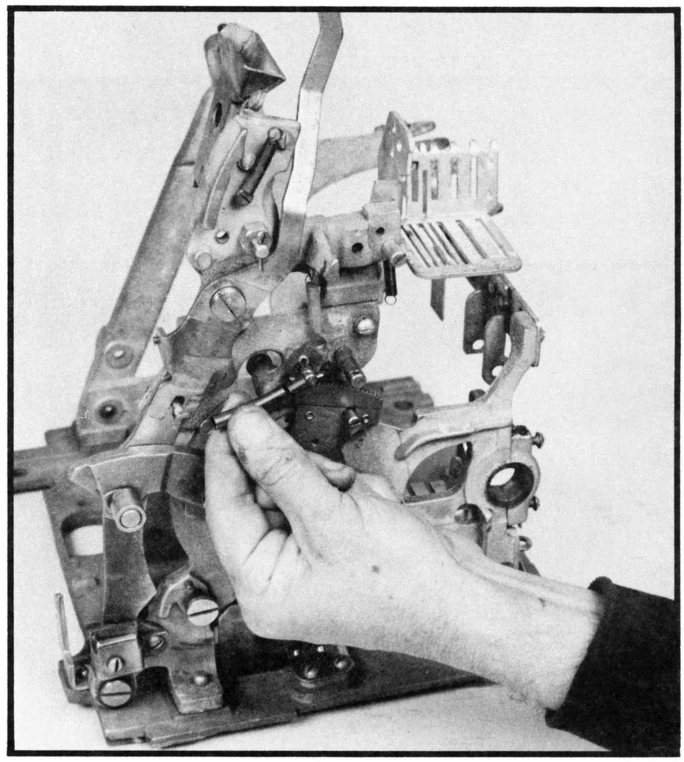


Figure 6.49

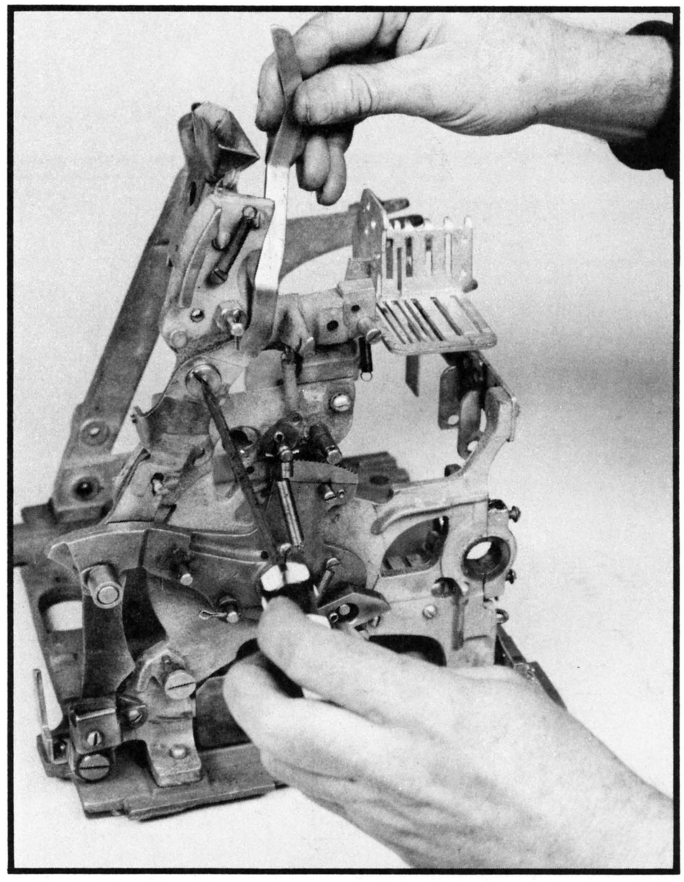


Figure 6.50

the assembly. Generally speaking, this device is rarely used and is often more trouble than it is worth. Its main function is to inhibit payouts from occurring when checks are played rather than coins. This assembly is extremely susceptible to jamming and sticking, and if it is to be reincorporated into the mechanism, it should be thoroughly cleaned so all parts move freely.

The coin detector operating lever is removed as shown in Figures 6.49 and 6.50 by first removing the extension spring and then by unscrewing the shoulder screw and removing the lever from the frame. Be sure

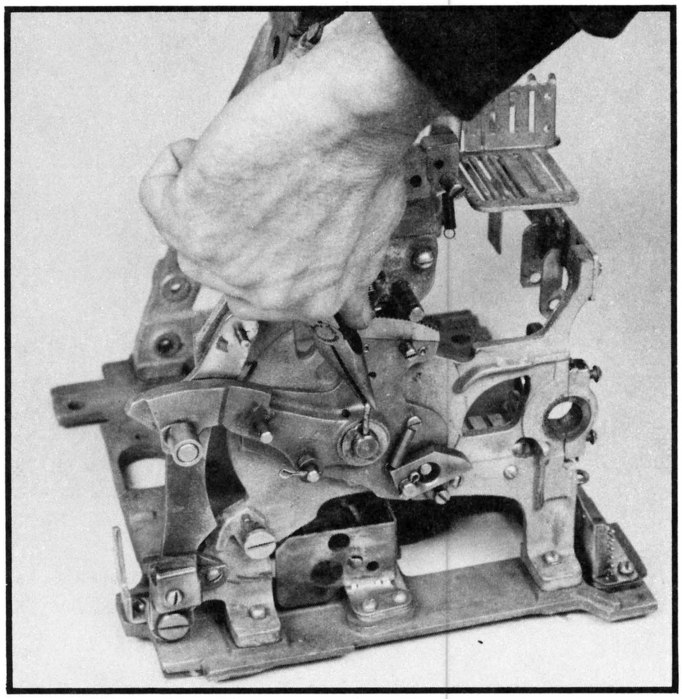


Figure 6.51

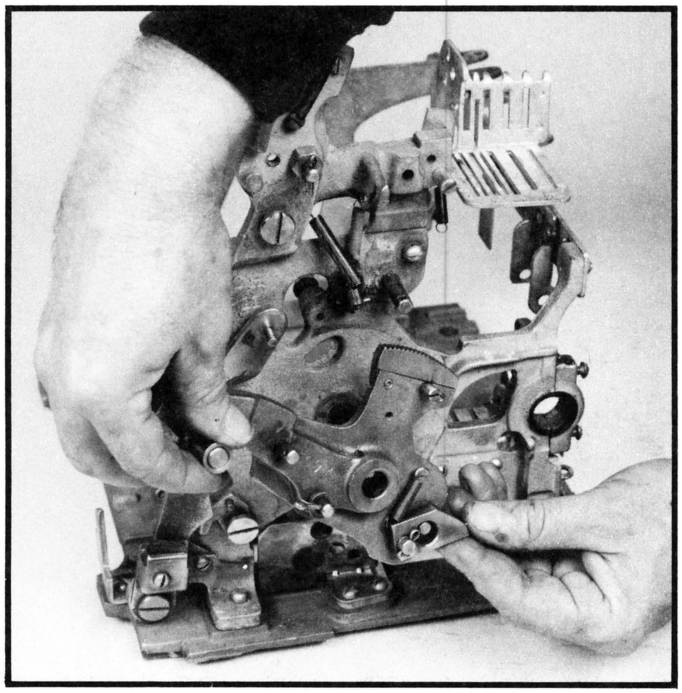


Figure 6.52

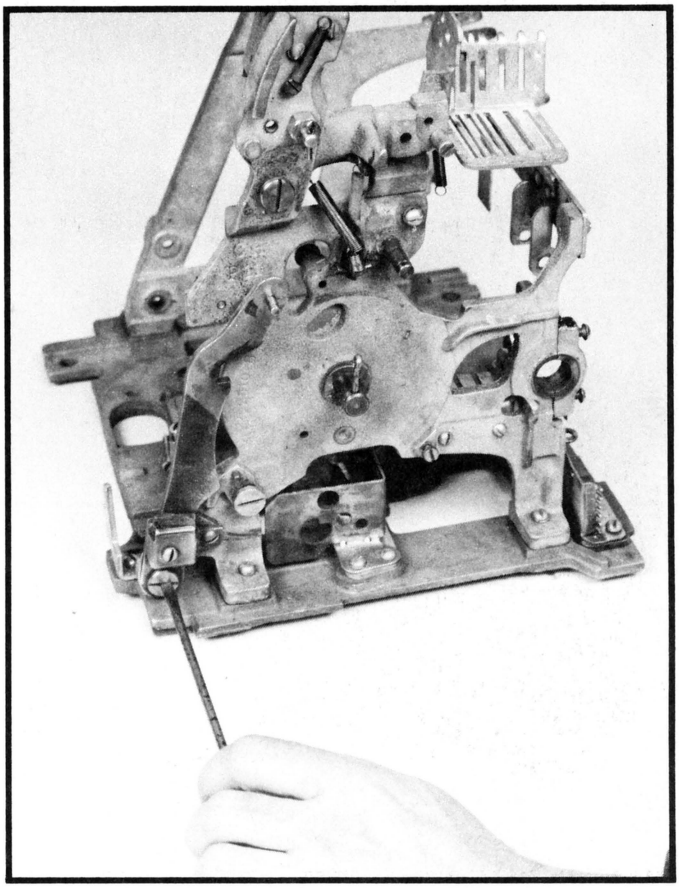


Figure 6.53

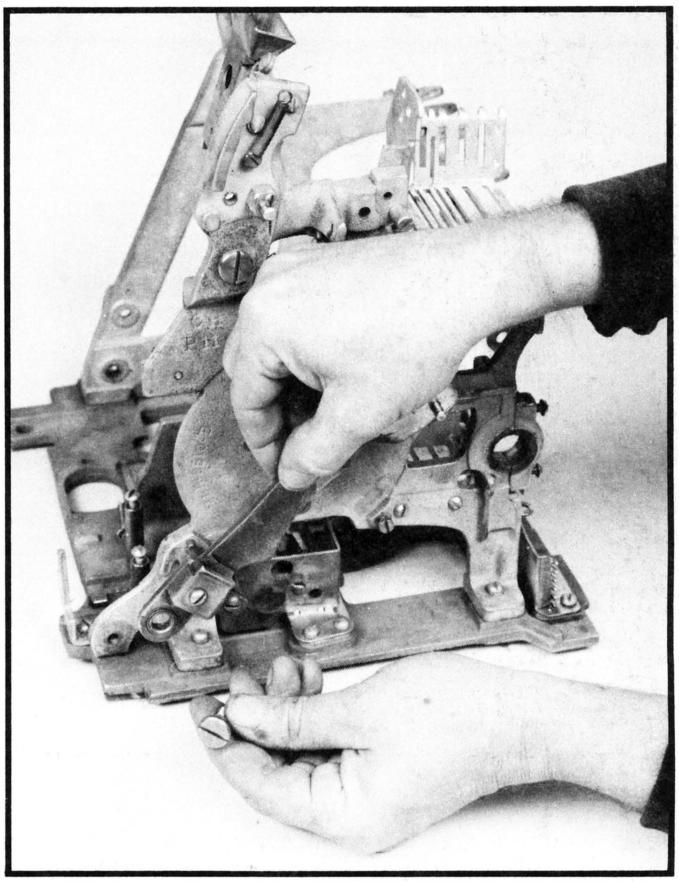


Figure 6.54

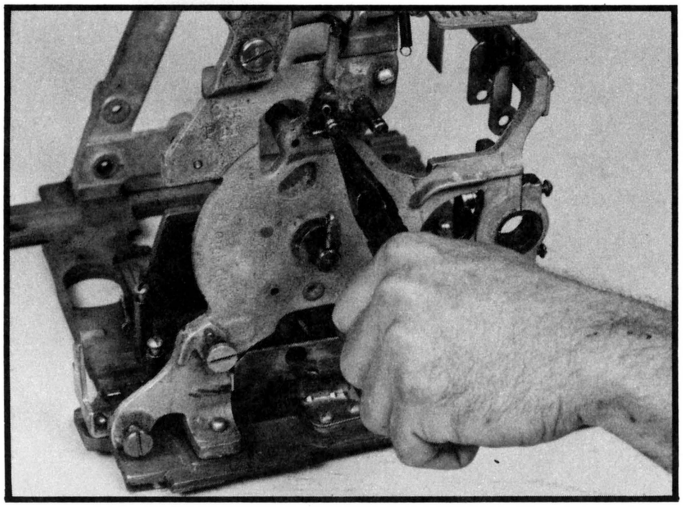


Figure 6.55

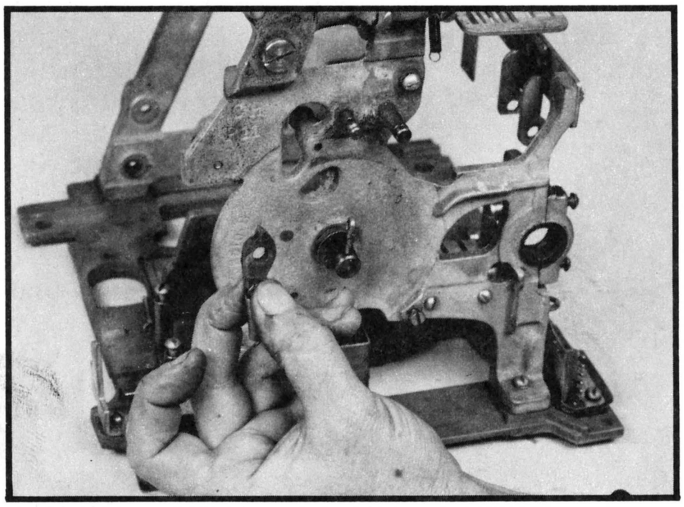


Figure 6.56

to replace the shoulder screw.

The main operating lever assembly is removed as shown in Figures 6.51 and 6.52 by first removing the cotter pin and washer, then lifting the lever away from the assembly.

The operating lever lock assembly is removed as shown in Figures 6.53 and 6.54 by first unscrewing the shoulder screw and then removing the lock assembly arm. Be sure to replace the shoulder screw.

Finally, the operating lever dog can be removed from the frame, as shown in Figures 6.55 and 6.56, by removing the cotter pin and washer and then unwinding one end of the spring away from the dog.

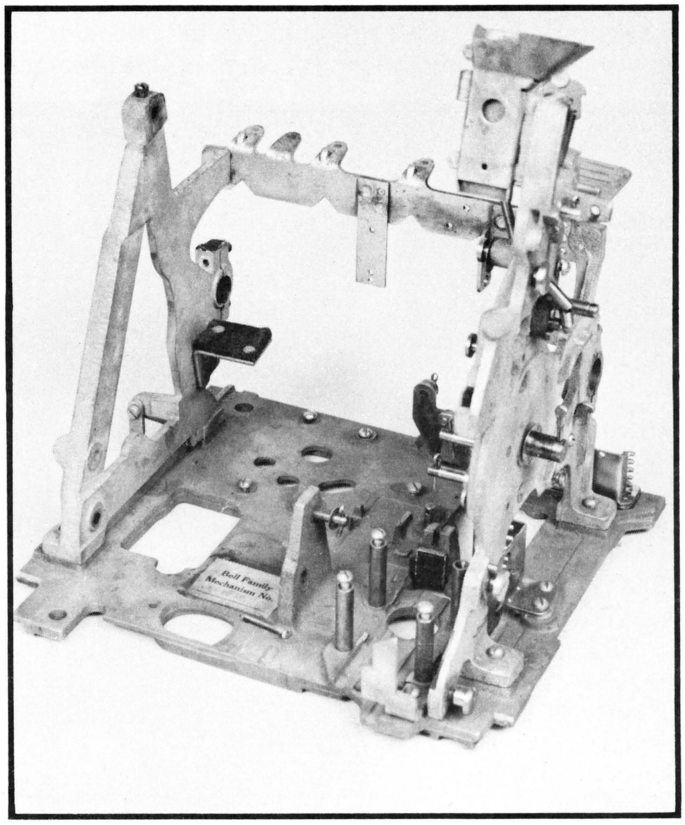


Figure 6.57

If all the above instructions have been followed, the frame skeleton of the mechanism will be left as shown in Figure 6.57.

7 Detailed Theory of Operation

Introduction

In this chapter, each function of the operating mechanism will be explained in complete detail. For each function to be explained, all of the parts associated with that function will be shown, their location on the mechanism illustrated and the manner in which they operate will be demonstrated on a step-by-step basis. In performing this type of functional analysis of the mechanism, it will be necessary to do partial assemblies which would not normally be done in the assembly of the machine. Various break-away photos necessitate removal of portions of the frame. Physically having the mechanism in front of you will be of great value in following the explanations.

The ideal way to go through this chapter and consequently learn exactly how the mechanism operates is to have a totally disassembled mechanism and to follow along with the descriptions given of the operation of the various functions of the mechanism. It is not necessary, however, to have a disassembled mechanism as long as one has a working mechanism and can follow through the maze of levers and the particular functions being explained while operating the mechanism. As mentioned previously, all of the mechanisms dating back to 1932 are functionally the same, and while there are a few variations in the design of the parts, the mechanisms perform functionally the same; so the lessons learned from this chapter are applicable to almost all Mills machines made that employ the escalator as the method of coin detection and acceptance. Another useful purpose of this chapter is that it becomes a guide to machine troubleshooting since most troubles occurring in mechanisms begin with some form of a symptom, which can generally be traced to at least one or two particular functions. Identifying the inoperative functions and understanding what they should be doing and then observing what the mechanism is doing is the first step in fixing the particular problem that plagues the inoperative machine.

The Wind-Up and Release System

Figure 7.1 shows the main operating fork assembly above and the main operating lever and dog assembly below. As the slot machine handle is pulled down, its motion is imparted to the main operating lever, rotating it, and consequently the operating fork. Figure 7.2 shows these two parts installed on the frame of the machine in their ready or rest position. When the handle on the slot machine is pulled down, the main operating lever is rotated to the position shown in Figure 7.3, which is the fully wound-up position of the machine. As the operating lever is rotated further, the operating fork falls off of the dog on the operating lever and returns to its normal or unwound position as shown in Figure 7.4. When the handle on the slot machine is returned to its full upright position, the operating lever will then be allowed to return to its original position as shown in Figure 7.5, with its dog having slipped back over the operating fork pin and ready to repeat the action for another cycle.

The almost immediate transition of the operating fork shown in Figure 7.3 to its position shown in 7.4 corresponds to the kicking and spinning of the reels. The details of this action will be explained later in this chapter.

The main operating lever simultaneously provides several other different functions. These functions include the driving energy to the escalator, the sensing of coins in the escalator, coin tube management and

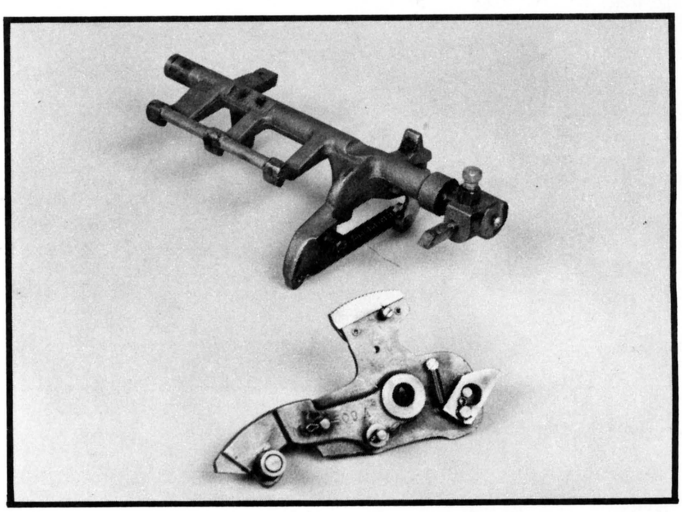


Figure 7.1

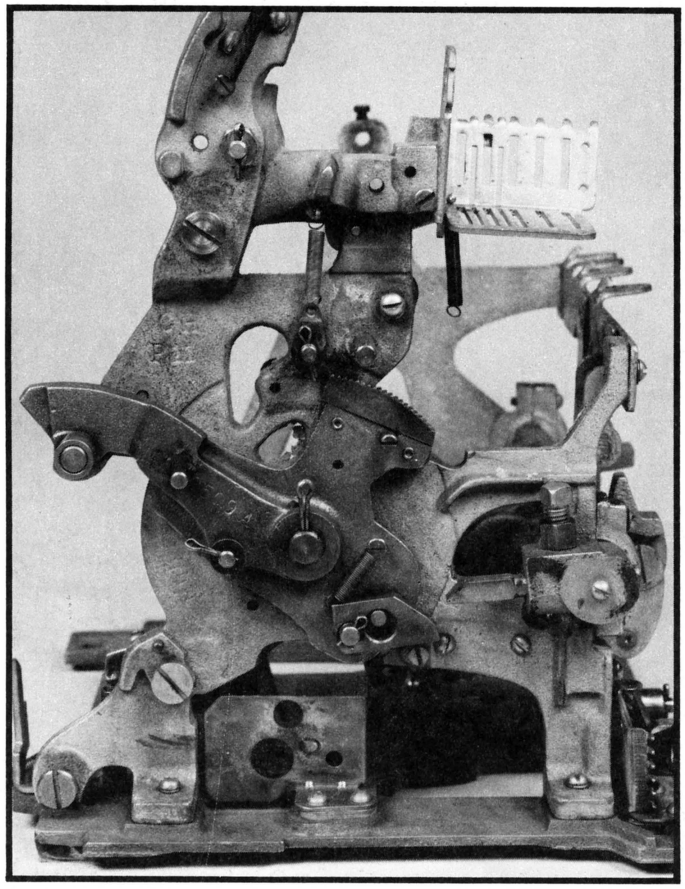


Figure 7.2

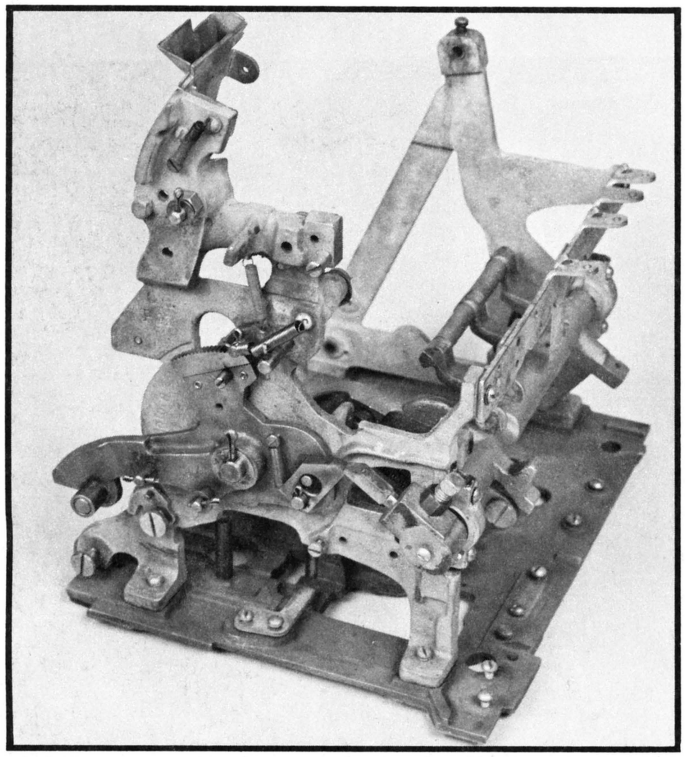


Figure 7.3

sensing of checks in the escalator. Each of these operations will be considered in detail later in this chapter.

During the wind-up cycle, the operating fork is also

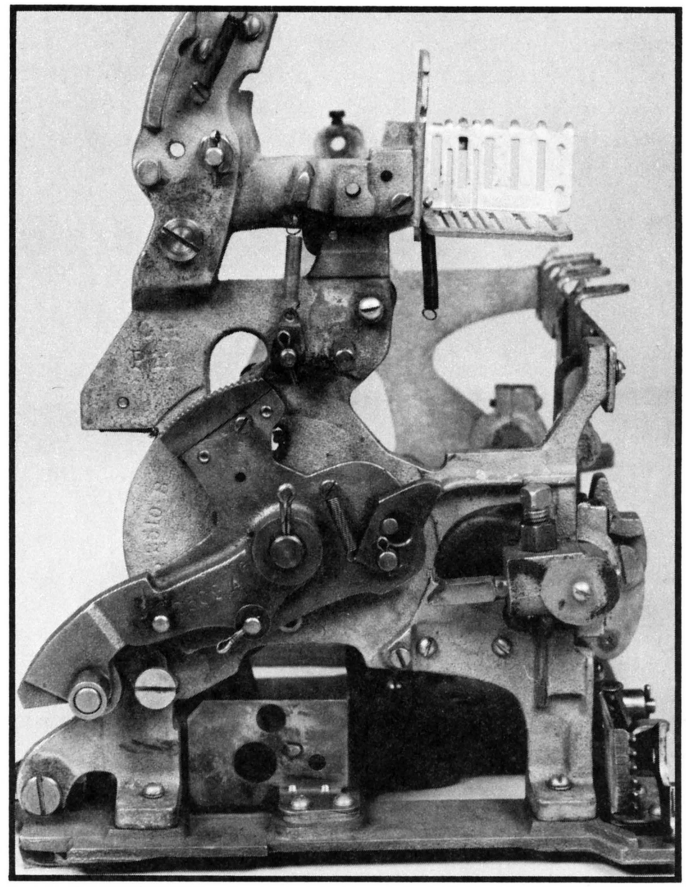


Figure 7.4

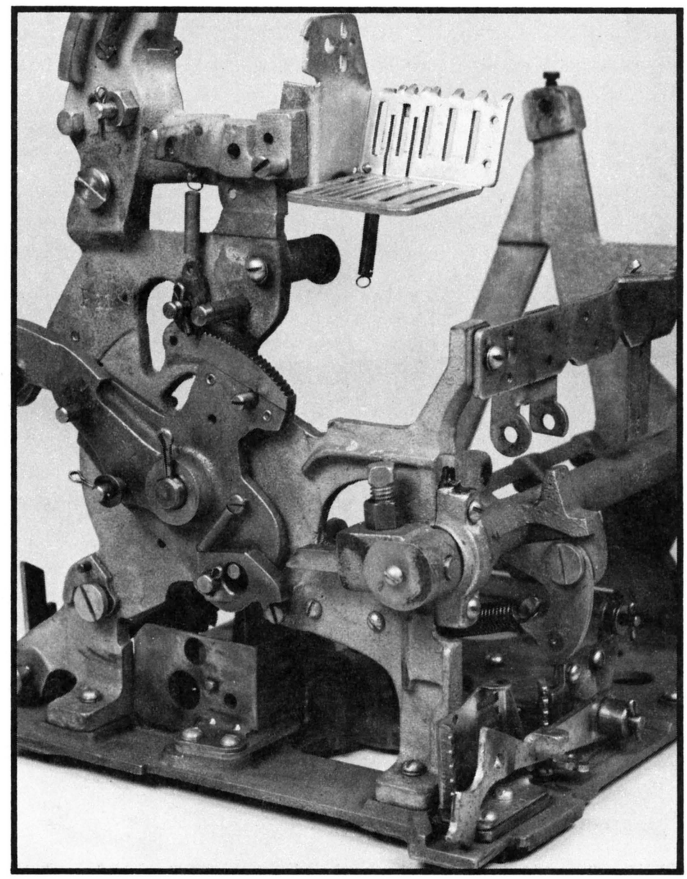


Figure 7.5

simultaneously providing additional functions. These functions include cocking of the payout slides, the cocking of the vertical payout levers, the winding-up of the clock and the resetting of the various timing levers. Each of these operations will be considered in detail later in this chapter.

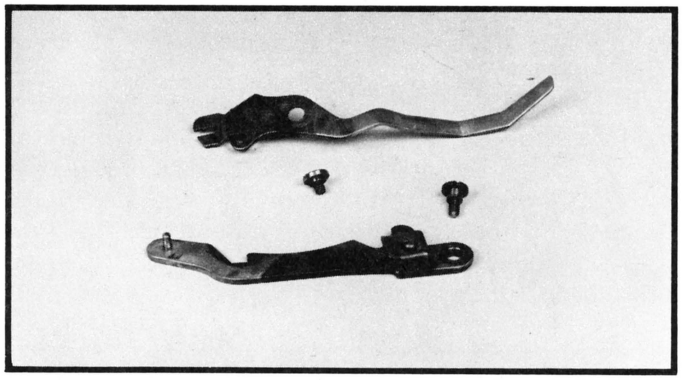


Figure 7.6

Coin Detector and Lock Assemblies

Figure 7.6 shows the coin detector operating lever above and the operating lever lock arm below with their associated shoulder screws. It is the function of these two levers to allow the main operating lever to be pulled down if there is a coin present in the escalator and to inhibit motion of the operating lever if a coin is not present in the escalator. Figure 7.7 shows these two levers mounted on the side of the frame with the extension spring which has been connected

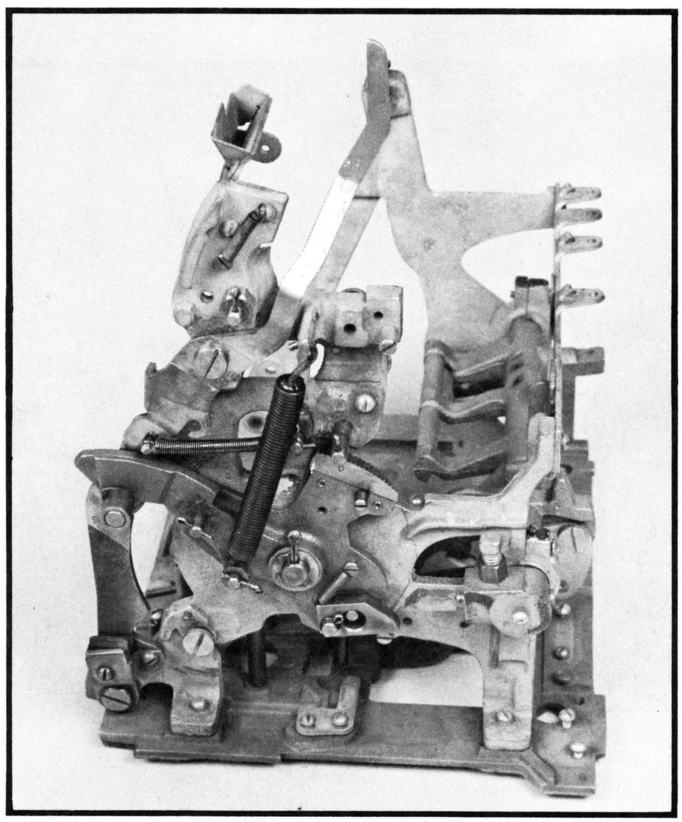


Figure 7.7

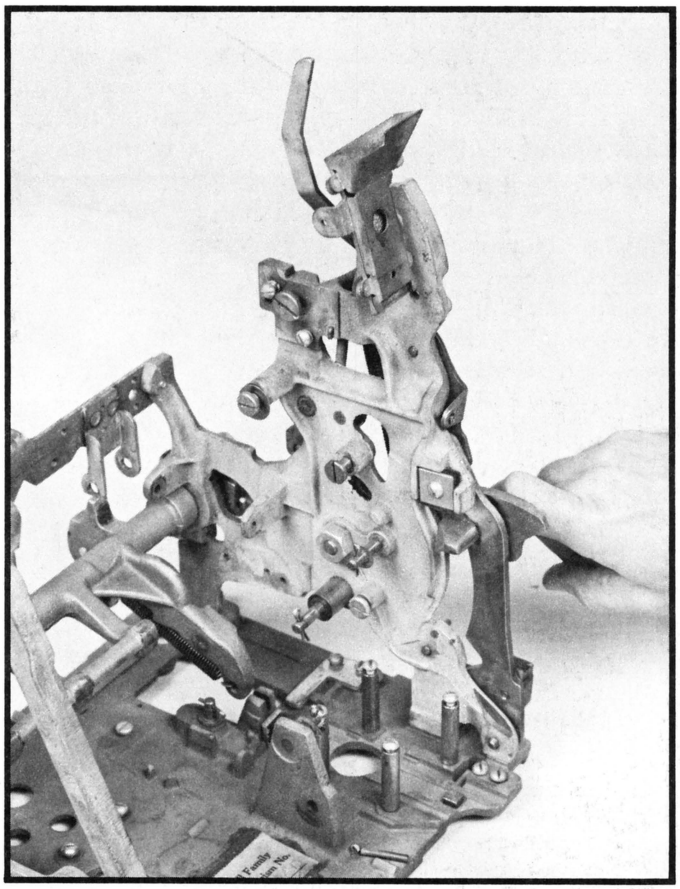


Figure 7.8

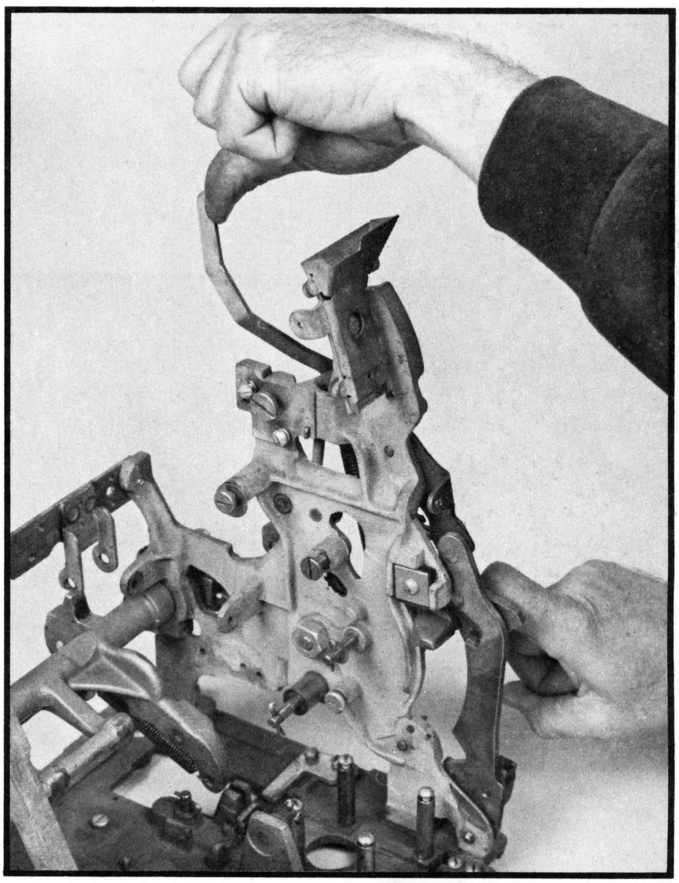


Figure 7.9

to the coin detector lever in order to provide the tension necessary for its attempted forward travel. The main operating lever extension spring has also been placed on the mechanism to provide tension on the main operating lever for returning it to its ready position.

Figure 7.8 demonstrates what occurs when an attempt is made to cycle the main operating lever when there is no coin present. As the operating lever is depressed, the coin detector lever begins traveling forward. As the operating lever is further depressed, it is eventually stopped, and further travel is prevented by the stop lever. Releasing the operating lever allows it to return to its ready position. Figure 7.9 shows what happens when the coin detector lever is inhibited from traveling forward while the operating lever is depressed. The stop lever is now kept out of the way of the path of travel of the main operating lever. Figure 7.10 shows the eventual travel of the operating lever to its full bottom position, completing the wind-up cycle of the machine. The inhibiting of the forward travel of the operating lever is ultimately caused by the escalator when a coin has been properly accepted by it. This interface and operation will be covered in detail in the escalator section. Notice also that when the operating lever is pressed fully down, the attempt of the coin detector lever to travel forward stops and it is held by the mechanism in its backward position.

A similar lever is used for gooseneck-type machines and is explained in detail in Appendix C.

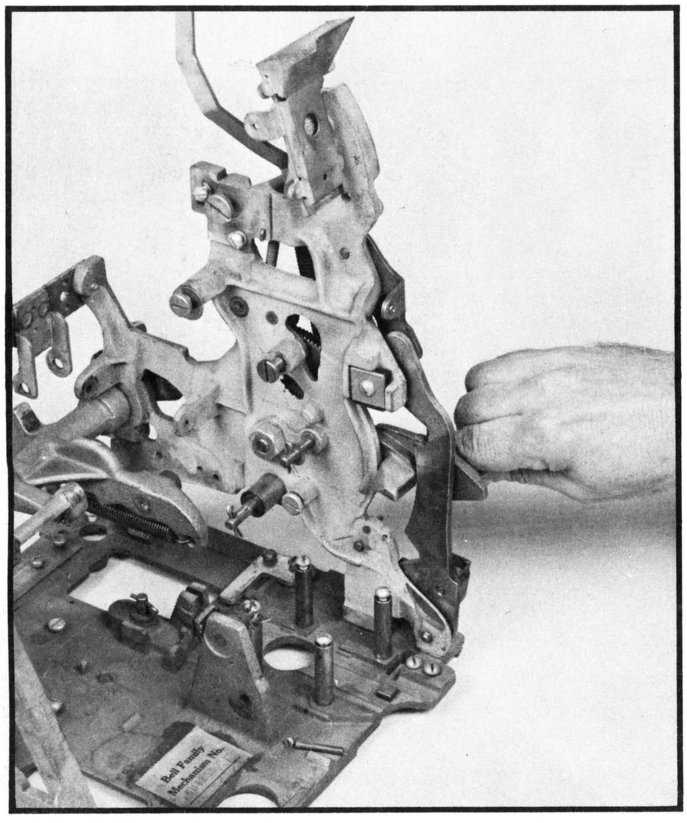


Figure 7.10

Advancing the Coins in the Escalator

The coins in the escalator are advanced by means of the coin advance bar operating lever shown in Figure 7.11 with its corresponding extension spring. This bar, when coupled to the escalator, provides the necessary motion for the advancement of the coins in the escalator. Figure 7.12 shows this lever installed on the frame of the mechanism with its associated extension spring.

If the main operating lever is pulled down and the coin detector lever inhibited as previously shown in Figure 7.9, the coin advance lever will travel downward and be in the position shown in Figure 7.13. As the main operating lever is further depressed, the coin advance bar is inhibited from traveling any further, but the slack or the additional motion is represented

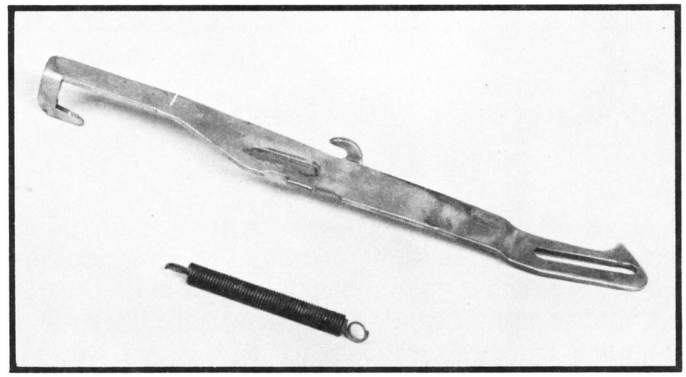


Figure 7.11

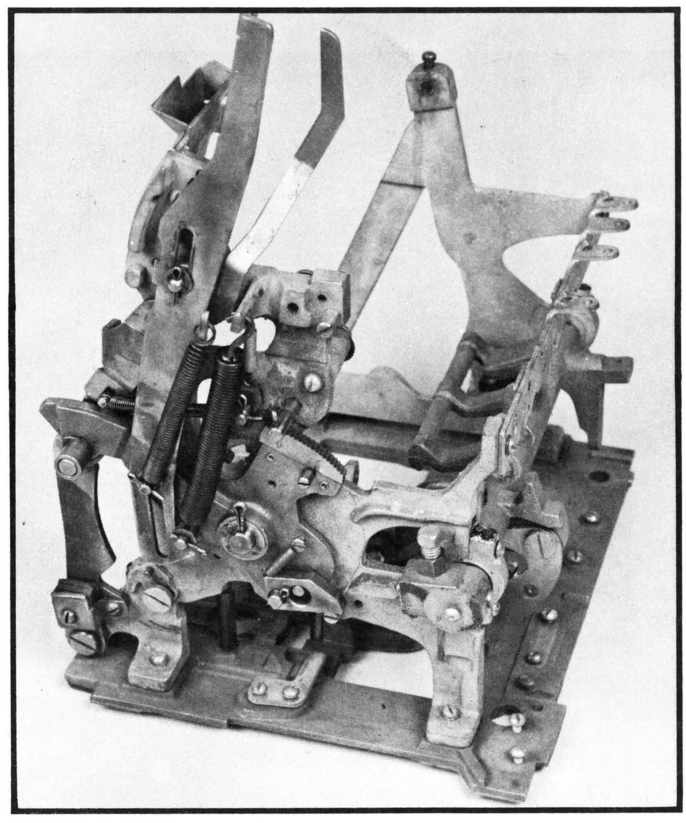


Figure 7.12

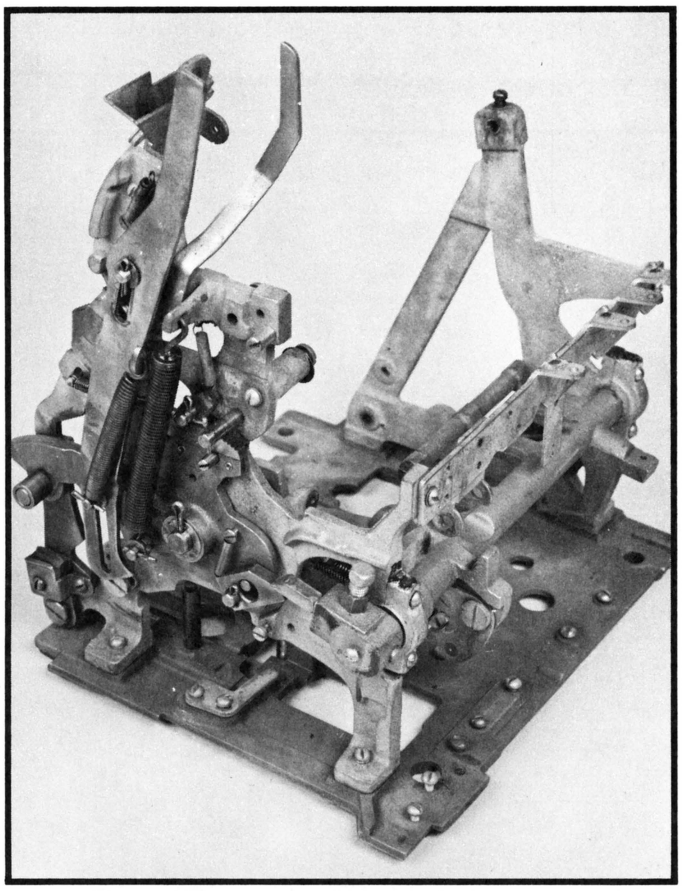


Figure 7.13

by an extension of the extension spring as shown in Figure 7.14.

It is important to note the exact way that the main operating lever moves the coin advance bar. The operating lever is connected to the coin advance bar extension spring and it is this extension spring that powers the coin advance bar. The extension spring is kept under tension such that the advance bar follows the operating lever so long as the motion of the coin advance bar is not impeded. Thus, in Figure 7.13, when the coin advance bar can travel no further, then the operating lever continues downward without it by placing more tension on the extension spring. This coupling mechanism is important to understand since it will come to play later in this chapter in showing potential ecalator jamming situations.

A similar advance bar is used to force coins through the gooseneck of earlier machines and is explained in detail in Appendix C.

Operating Lever Stop and Assembly

Figure 7.15 shows the operating lever stop and pin assembly with its extension wire and shoulder screw. It is the function of this lever to prevent the operation of the main operating lever *if* the coin advance bar cannot be pulled down. The situation arises when the escalator is either jammed, does not have coins in it or an attempt has been made to tampered with it. In either case the mechanism is prevented from cycling,

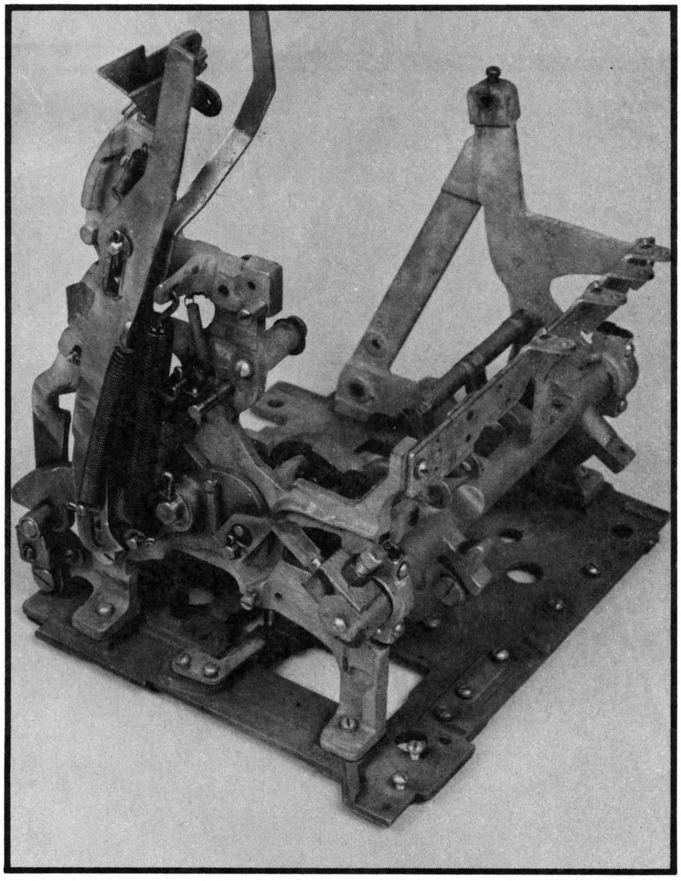


Figure 7.14

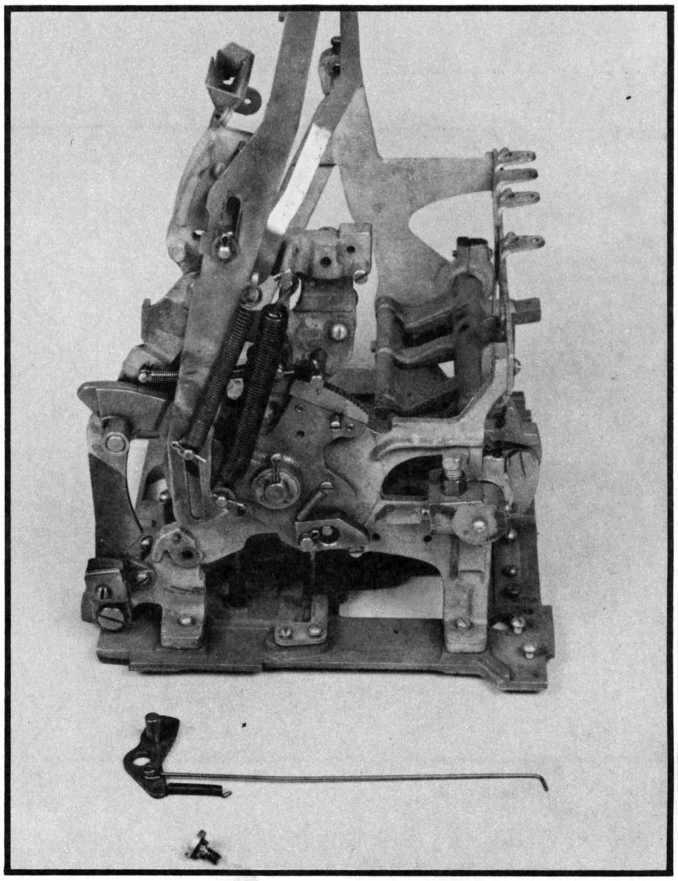


Figure 7.15

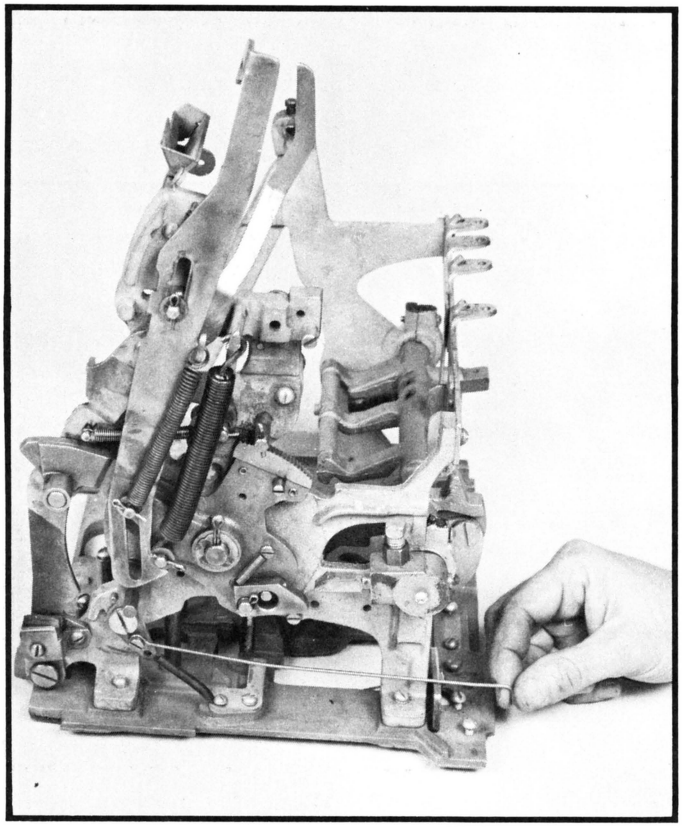


Figure 7.16

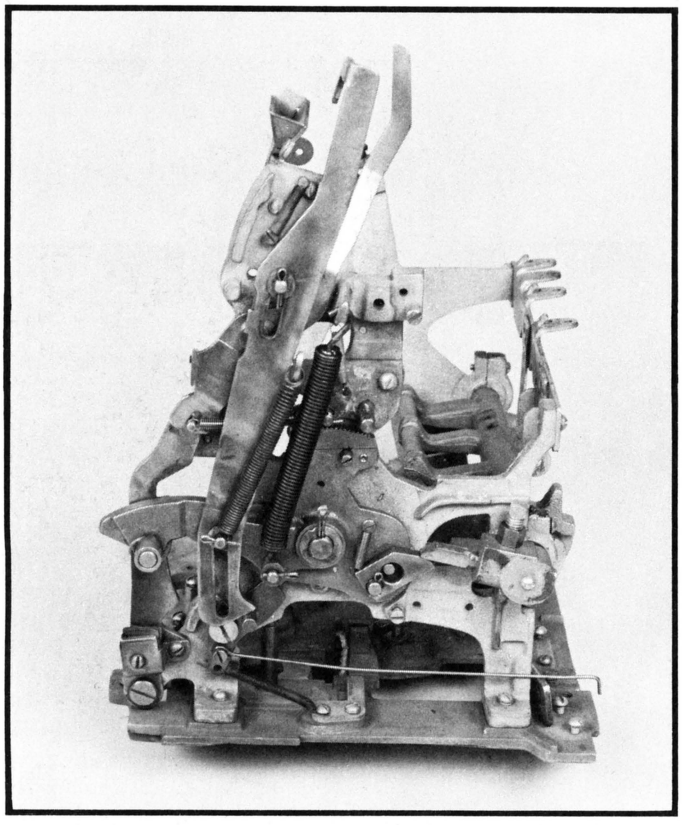


Figure 7.17

thereby preventing "free play" of the mechanism.

Figure 7.16 shows this lever installed on the frame when the mechanism is in its ready position. The hand is holding the end of the wire which can manually rotate the lever (this would be the case when attempting to unjam the mechanism). As the main operating

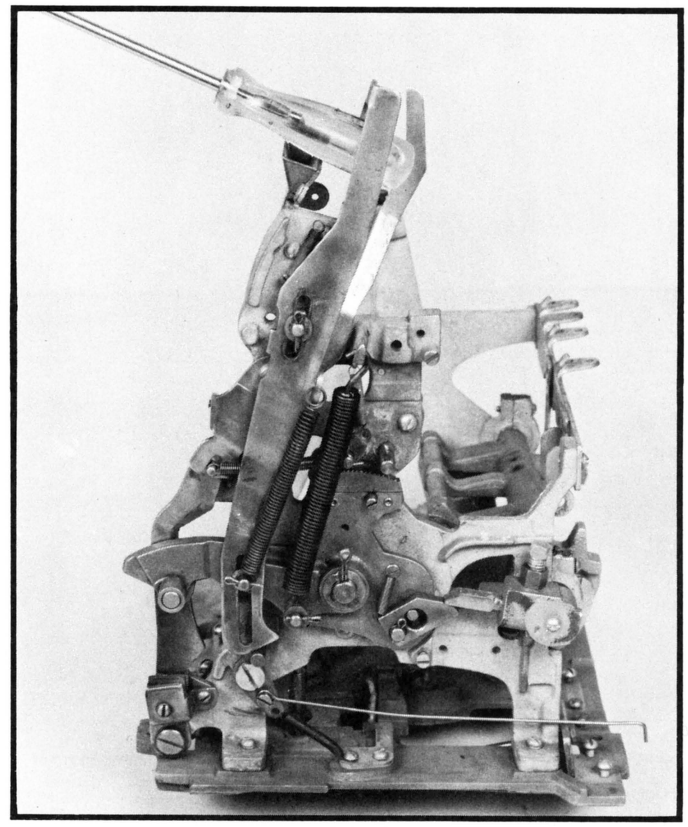


Figure 7.18

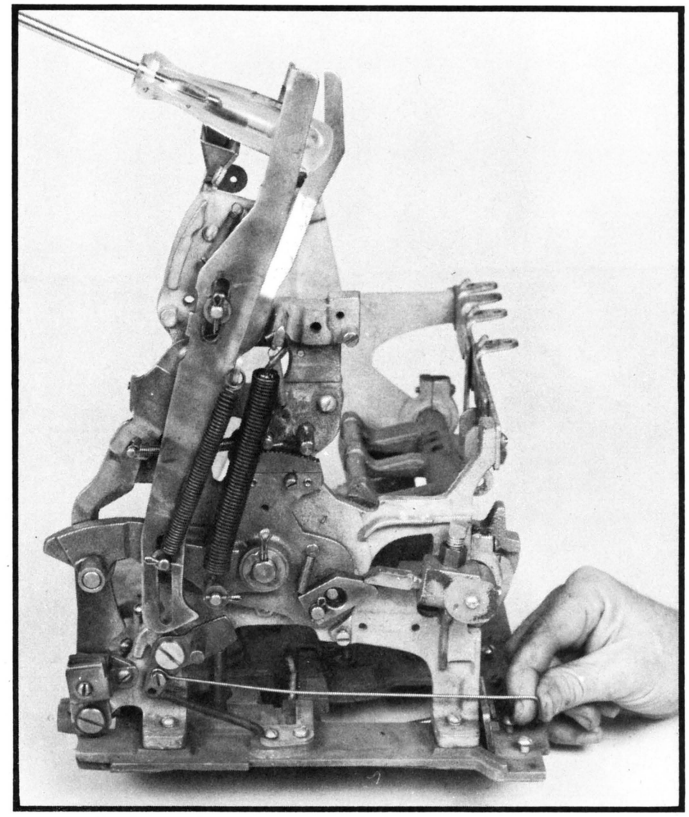


Figure 7.19

lever is pressed down, as shown in Figure 7.17 (again while holding back the coin detector lever so as to allow the mechanism to enter into the wind-up cycle), the coin advance bar engages the pin on the stop lever and starts to cam it out of the way, allowing the continued travel of the main operating lever. However, if the downward travel of the coin advance bar is impeded, as simulated by the screwdriver shown in Figure 7.18, then the coin advance bar will not arrive in time to rotate the stop lever out of the way, and the main operating lever will come to rest on the operating lever stop preventing any additional travel of the main operating arm. This condition can be overridden as shown in Figure 7.19 by manually pushing on the stop lever wire and thereby rotating the stop lever out of the way of the main operating lever. This situation is typical when the mechanism encounters an escalator jam while it is installed in the case. The best way to free the jam is to allow the mechanism to complete its cycle by pushing on the wire to manually rotate the lever stop, and once the tension is off the coin advance bar and the escalator, the mechanism may then be easily removed.

Coin Tube Overflow Management

Figure 7.20 shows the coin tube and the coin tube overflow pushlever assembly. It is the function of the overflow pushlever to rake off the coins from the coin tube after it is filled and push them into the overflow tube which leads to the jackpot in those machines having an automatic filling jackpot. Figure 7.21

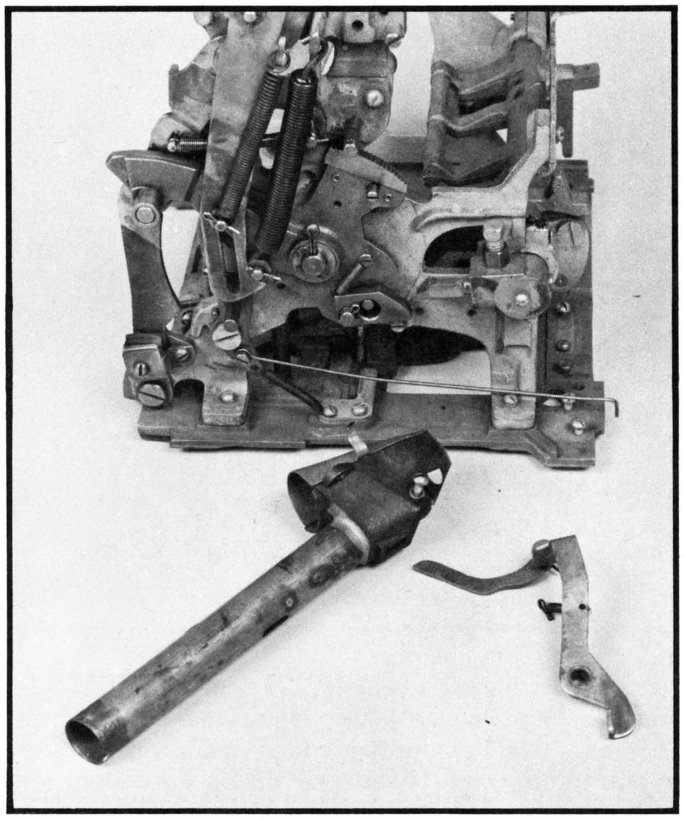


Figure 7.20

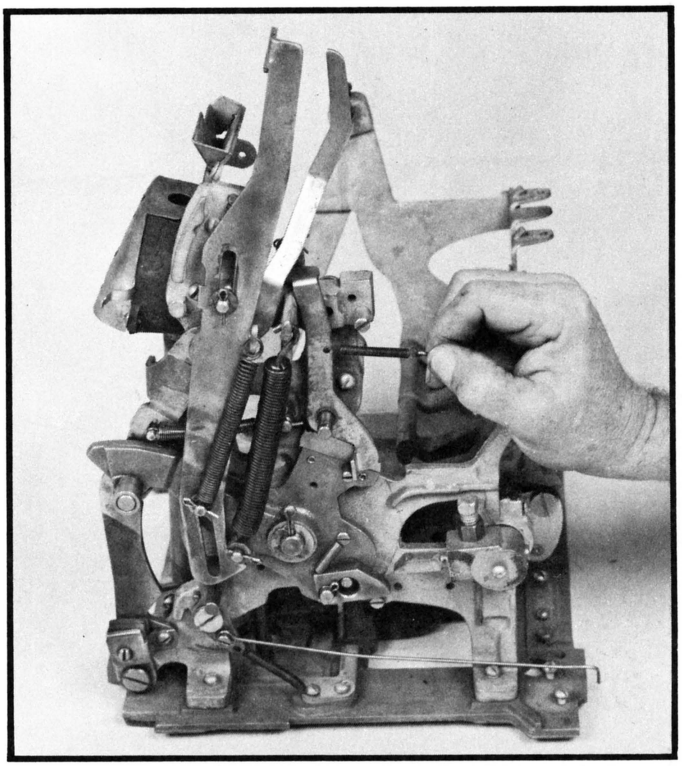


Figure 7.21

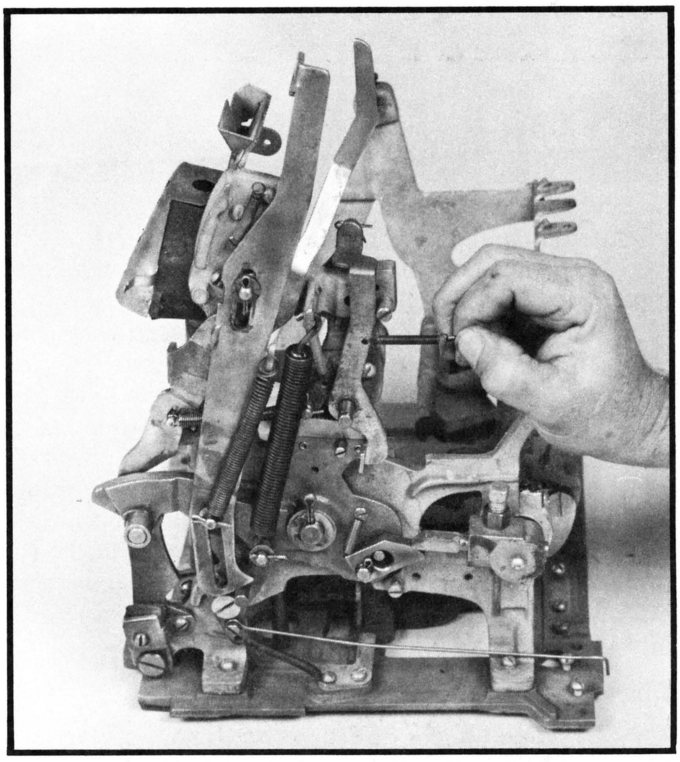


Figure 7.22

shows the coin overflow pushlever installed on the mechanism. The hand is temporarily holding the extension spring connected to this lever, since the part to which the spring is normally anchored has not been installed. The post on which this lever pivots will have an additional lever added to it later, but is shown in this manner for purposes of explanation.

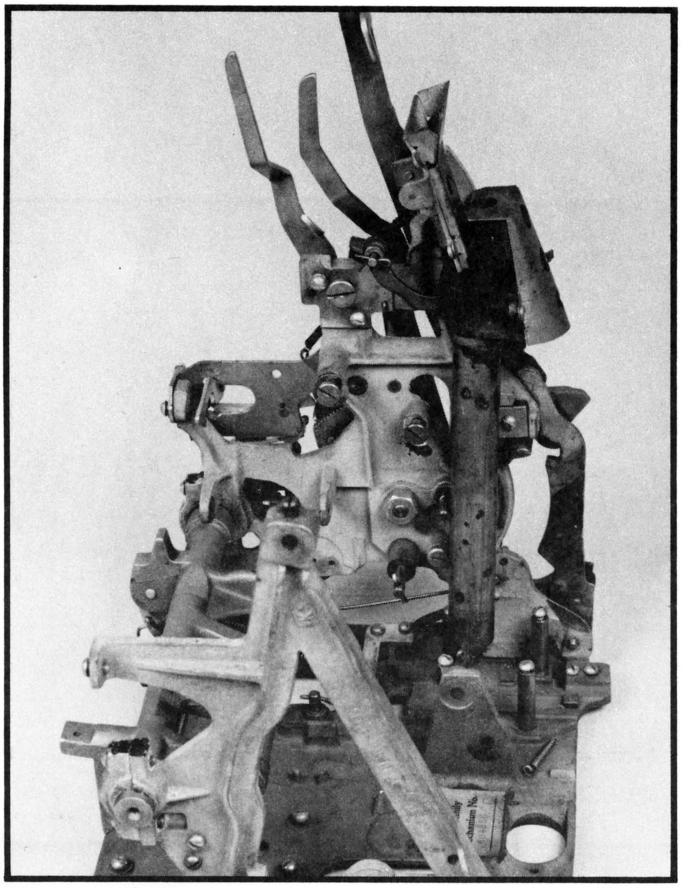


Figure 7.23

Figure 7.22 shows the forward motion of the coin overflow pushlever as the main operating lever begins the windup cycle. The motion of this lever is coupled on the other side of the frame to the small lever called the rake which is protruding into the top of the coin tube as shown in Figure 7.23. Each time the mechanism is cycled, the rake, via the coin overflow pushlever, makes one sweep through the top of the payout tube pushing any coins which may have accumulated into the coin overflow tube. It is important that this operation works smoothly since the piling of coins on the coin tube can lead to potential jamming in the escalator. Jamming happens when the coins are allowed to stack so high on the coin tube that additional coins coming in from the escalator have no place to go and thus back up into the escalator, causing the escalator to jam.

Check Detection in the Operating System

Figure 7.24 shows the three main components of the check detection operating system. The parts are, from left to right, the check detector operating arm assembly, release lever arm assembly and the anti-check payout base assembly. It is the function of these components to sense the presence of a check in the escalator and thereby perform certain deviations from coin operation. If a check is present then the downward travel of the release lever arm assembly is inhibited, preventing its interaction with the vender

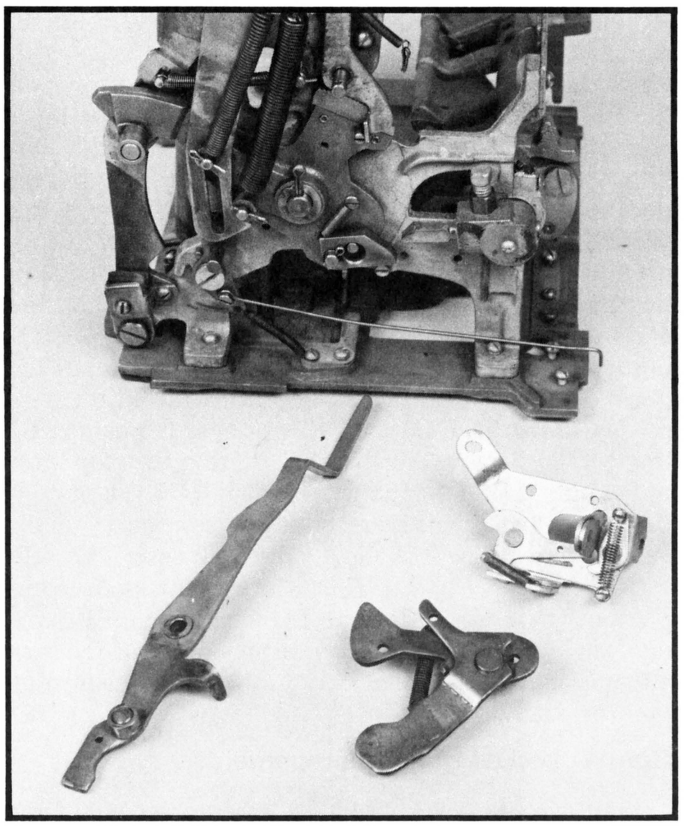


Figure 7.24

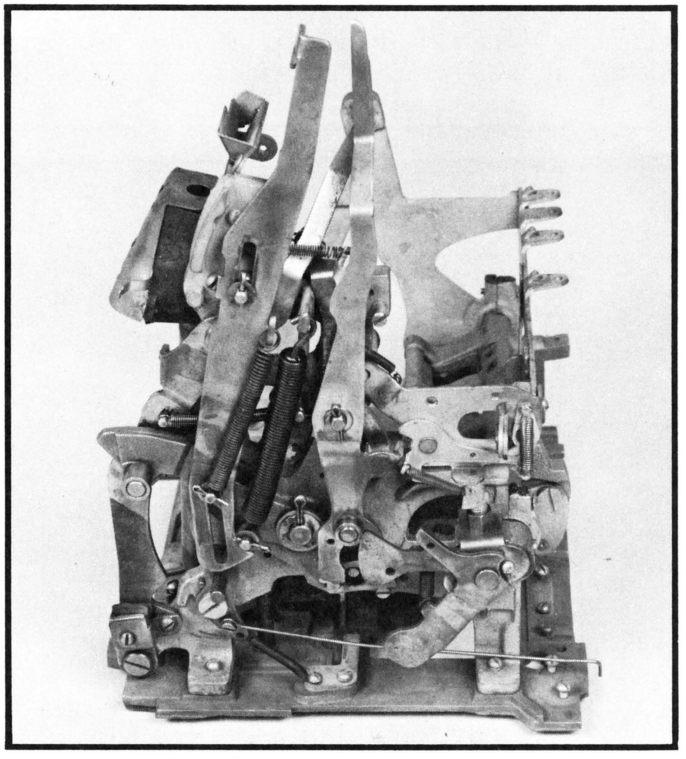


Figure 7.25

mechanism (if such a device is present). Vending occurs only when a coin is used for operation. According to the position of the lever on the base assembly, either normal payout continues or payout is inhibited from occurring.

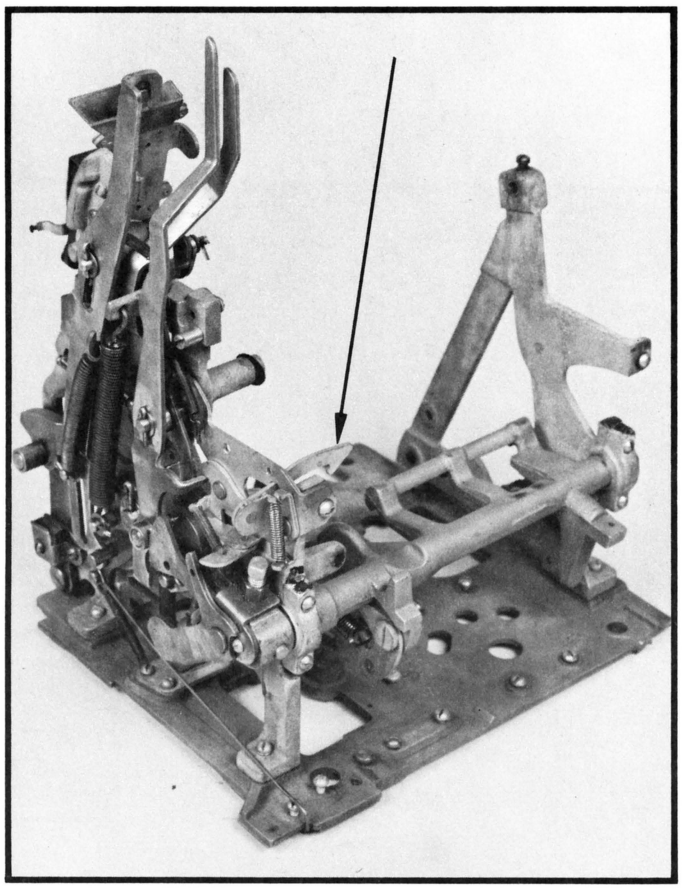


Figure 7.26

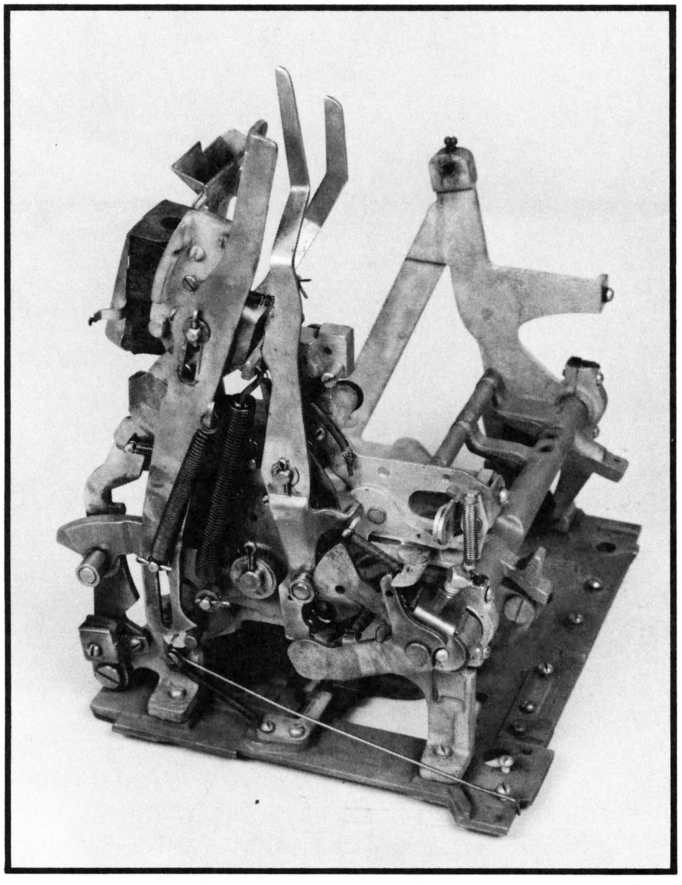


Figure 7.27

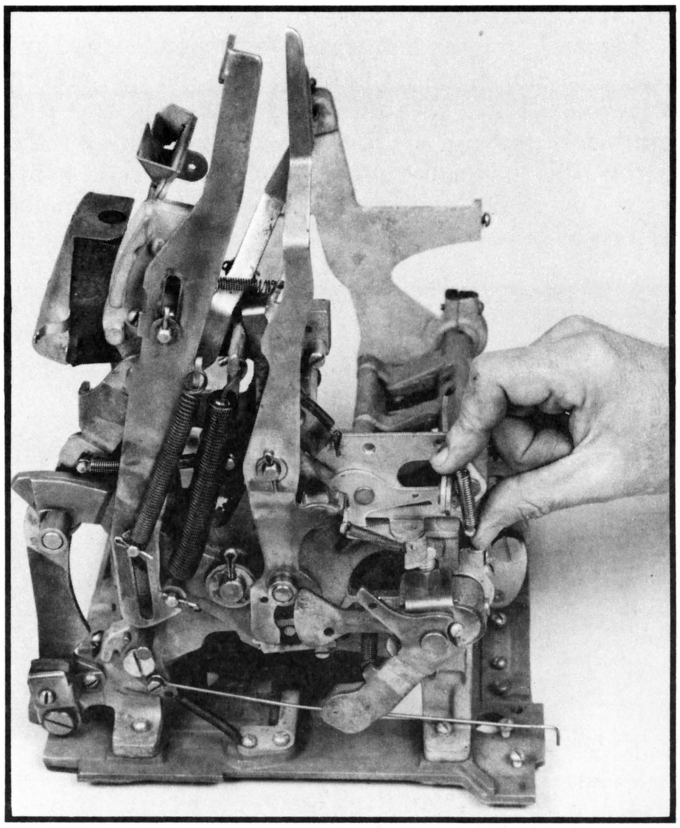


Figure 7.28

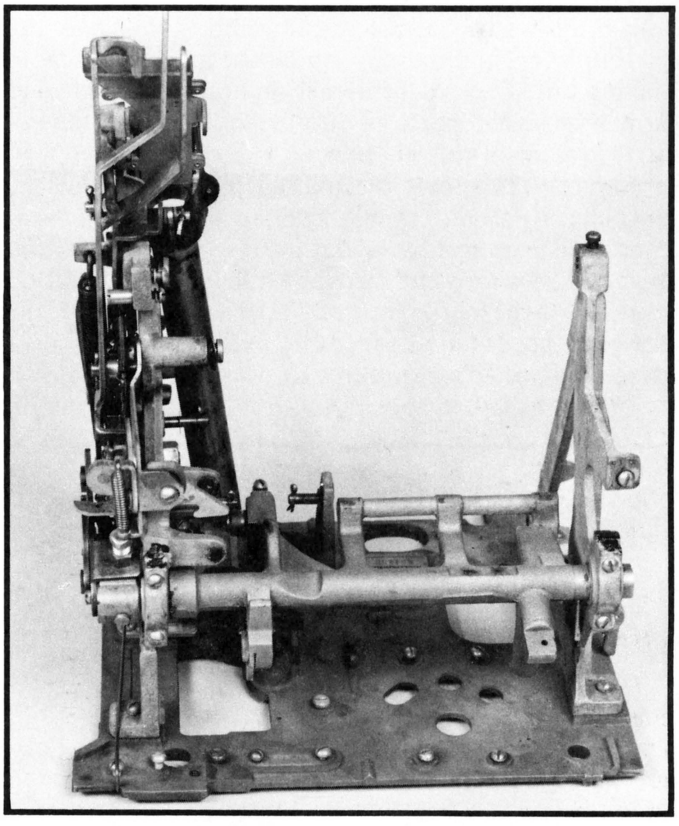


Figure 7.29

Figure 7.25 shows the three parts of the check detection and coin stop system assembled on the frame of the mechanism with the extension spring connected

to the check detector lever.

Figure 7.26 gives a different angle view of the anti-check payout assembly mounted on the mechanism showing the arm with the hook on the end of it (the anti-check payout control lever) indicated by the arrow. It is the relative positioning of this hooked arm by the check detection system that determines whether or not payouts will take place. Specifically, if this

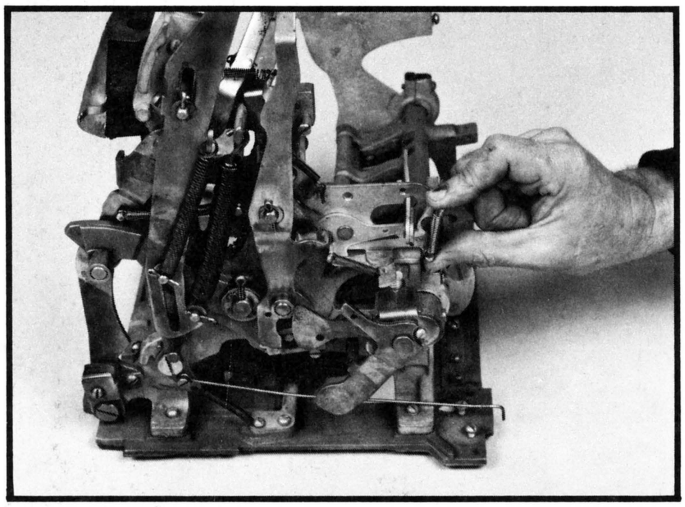


Figure 7.30

hooked arm is kept in the upper position, then the mechanism is free to make payouts; while if the mechanism allows this arm to be lowered, it will lock the payout levers and thereby inhibit the mechanism from paying out. The exact interaction of this hooked lever arm with other parts of the mechanism will be described later in this chapter.

Figure 7.28 shows the manual positioning of the anti-check payout control lever to the forward position, thus preventing payout during check operation. Figure 7.29 shows the mechanism during the wind-up cycle with the anti-check payout control lever in the forward position. During this cycle the hook lever described above will fall in a down position as shown in Figure 7.29. This position of the hook lever will ul-

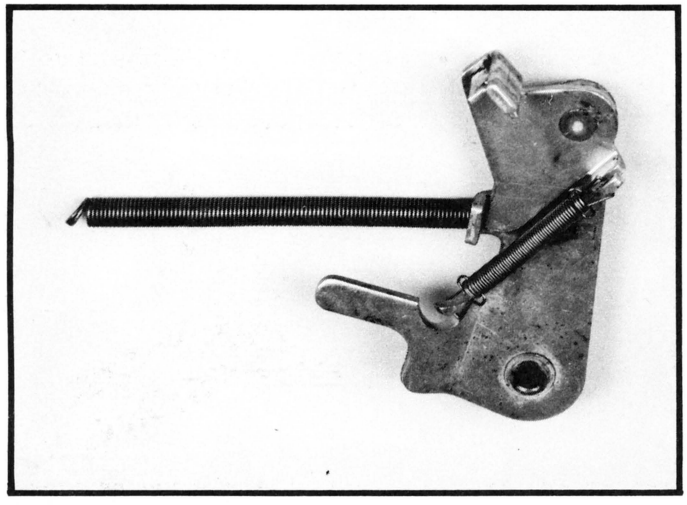


Figure 7.31

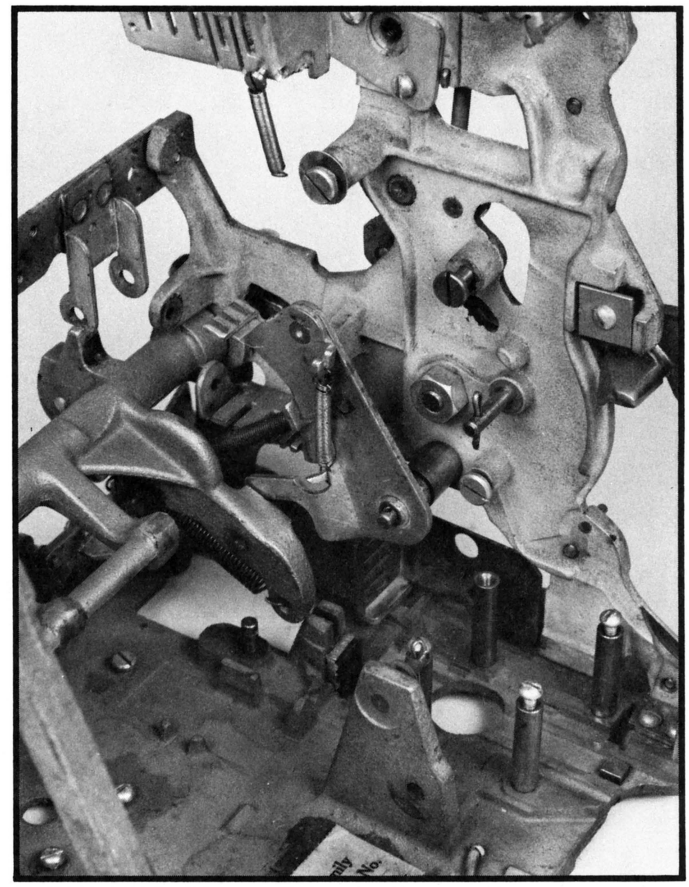


Figure 7.32

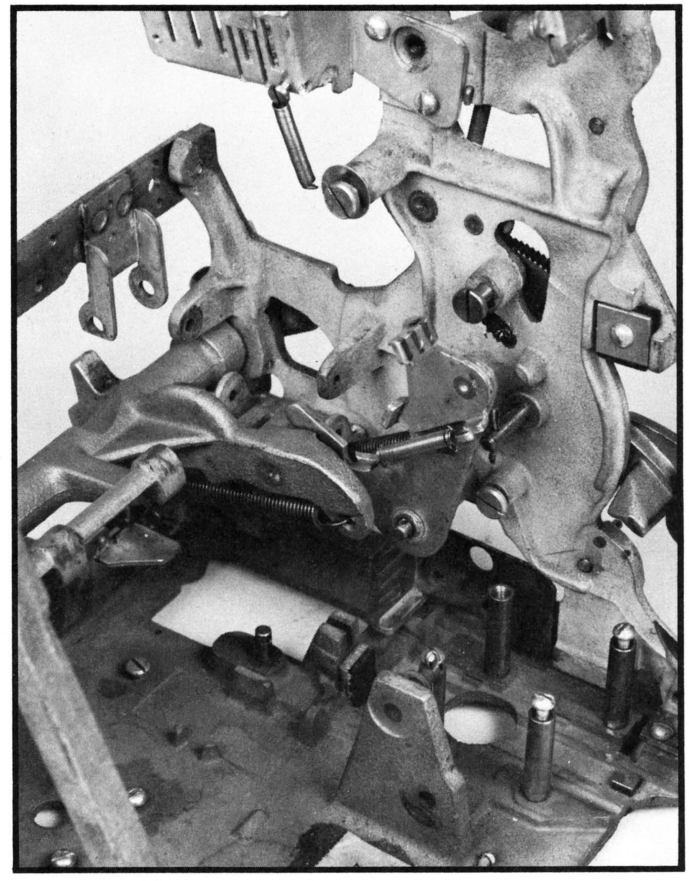


Figure 7.33

timately result in the inhibition of payouts.

When the anti-check payout control lever is positioned toward the rear as shown in Figure 7.30, the mechanism maintains normal operation and will perform payouts regardless of whether a coin or a check is present in the escalator. See Appendix C for gooseneck machine check detection.

Reel Spinning

The reel operating lever assembly (kicker) shown in Figure 7.31 is the assembly which comes into contact with the reel discs and sets the reel assembly in motion

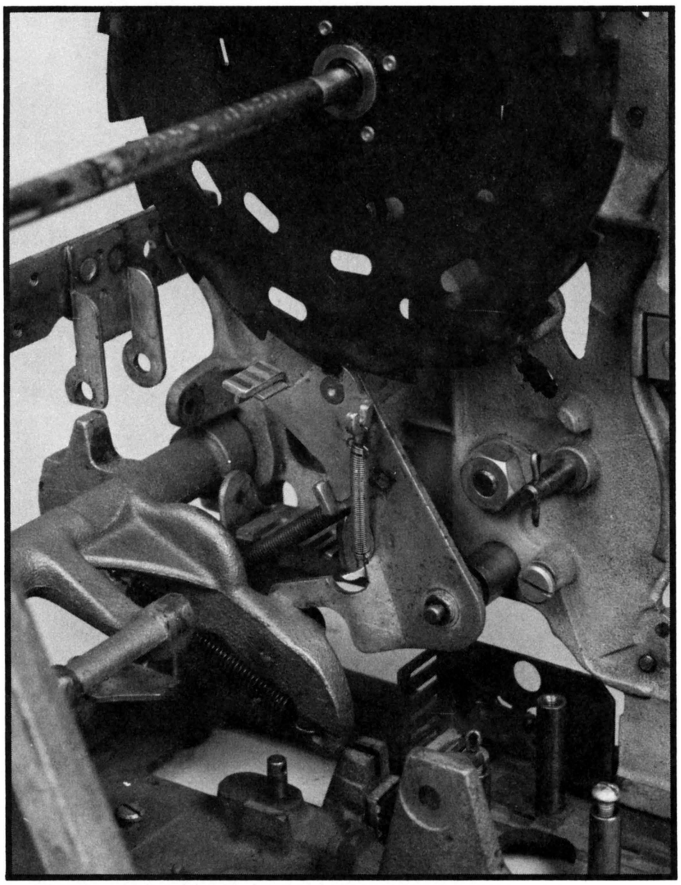


Figure 7.34

(see Appendix A for an earlier version). Figure 7.32 shows this assembly installed on the frame of the mechanism. Note that the extension spring attached to the kicker mechanism has its other end attached to the horizontal payout lever bracket located at the rear of the mechanism. Tension placed on the reel operating lever by the extension spring pulls against the main operating fork and thus, causes the fork to return to its neutral position once it has been released by the main operating lever during the release cycle.

Figure 7.33 shows the wind-up of the reel operating lever as the main operating lever is cycled through the wind-up cycle. It is the tension on the spring when the reel operating lever is released that provides the motion to the discs to start the reels spinning.

Figure 7.34 shows the mechanism with one reel disc

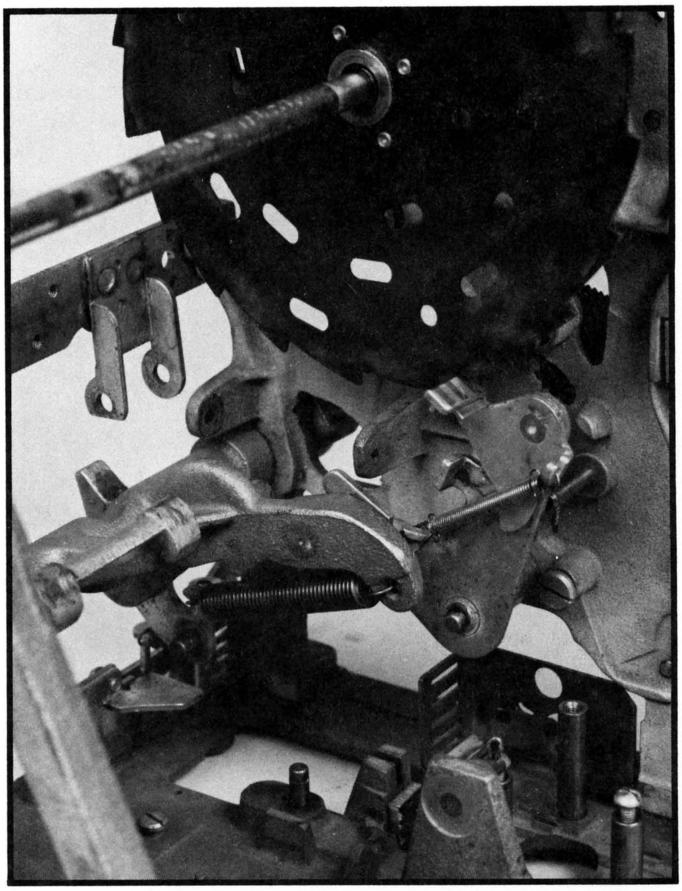


Figure 7.35

inserted in it to demonstrate the interaction of the reel operating lever with the discs. The position shown is in the ready position before the wind-up cycle is started. Figure 7.35 shows the reel operating lever in the fully cocked position at the end of the wind-up cycle and before it is released. It can be seen that the lever is firmly ratcheted in the teeth of the disc and that once released it will cause the disc and, consequently, the reels to spin. Once the reel operating lever has been released, it will return to the position shown previously in Figure 7.34, thus completing its cycle.

Payout Slide Resetting

Figure 7.36 shows the payout slide pushbar and its linkage bar which are used for resetting the slides

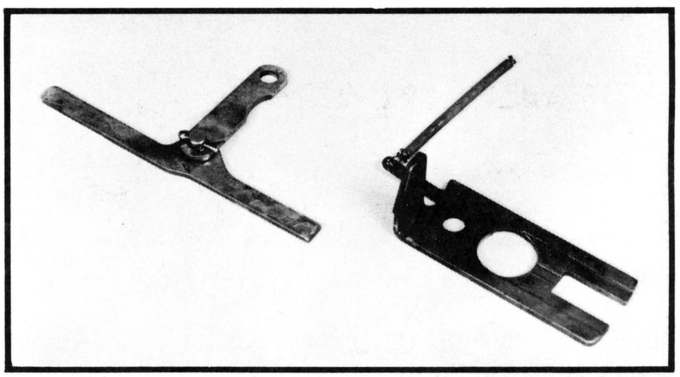


Figure 7.36

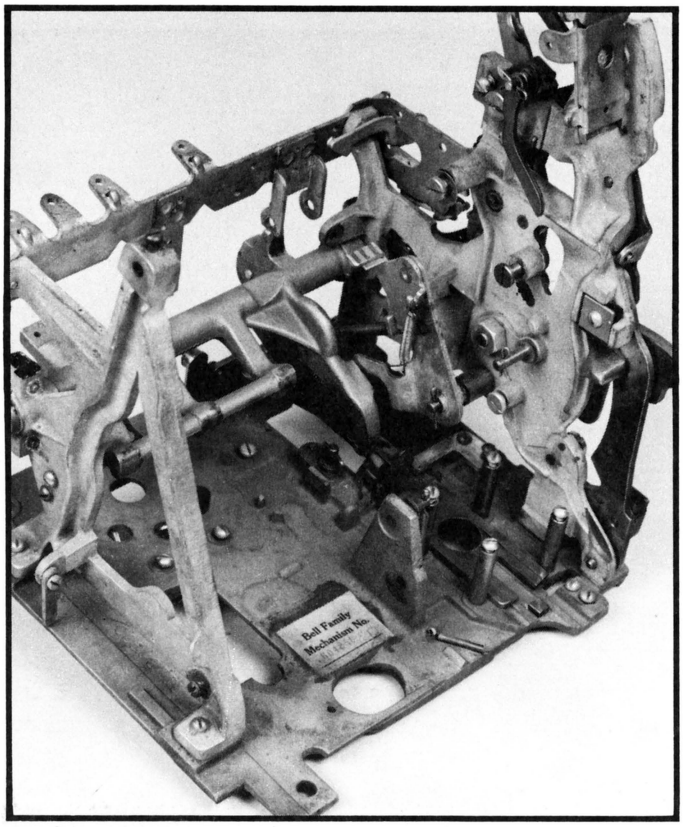


Figure 7.37

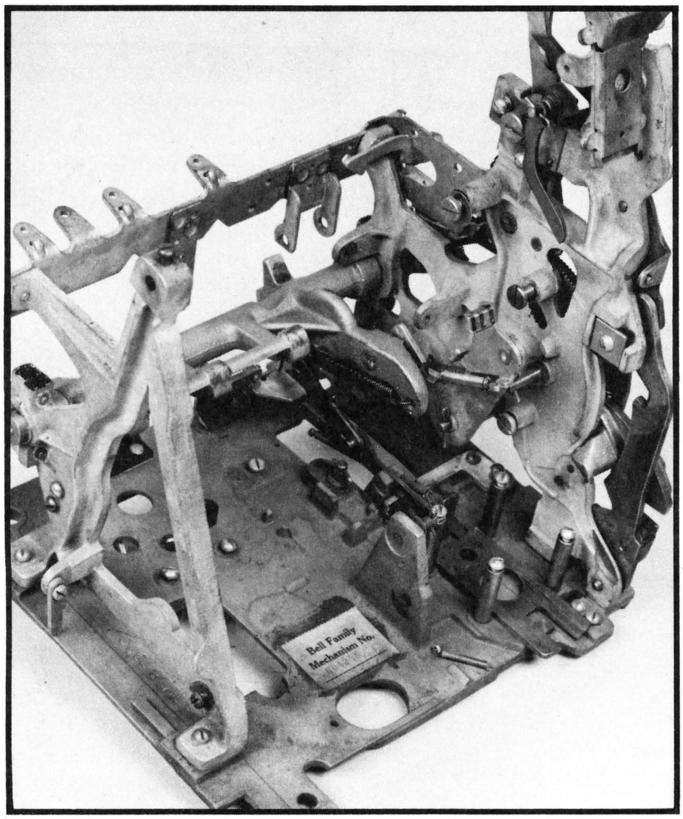


Figure 7.38

after each cycle of the mechanism. Figure 7.36 also shows the bottom or master slide, and it will be used for purposes of illustration of the interelation with the slide pushbar and master slide.

Figure 7.37 shows the payout pushbar and its linkage bar installed in the mechanism with the master slide in its proper position with the mechanism in the ready position. As the mechanism goes through its

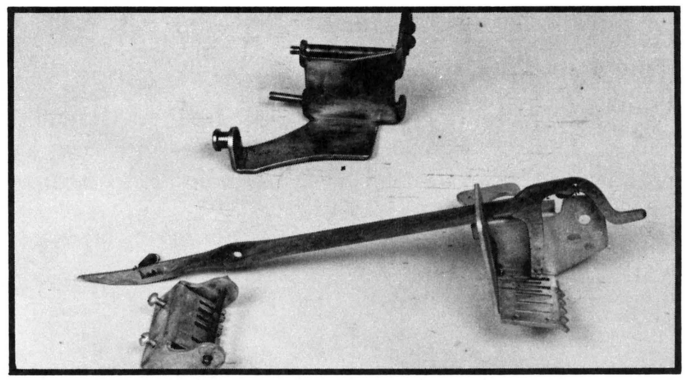


Figure 7.39

wind-up cycle, the payout slide pushbar is moved forward by means of the main operating fork and thus pushes the master slide forward as shown in Figure 7.38. Each time the mechanism is cycled the payout slide pushbar moves the master and safety slide forward, insuring the resetting of the master slide and all of the other payout slides which lie on top of it. The exact details of the slides being reset will be given later in this chapter.

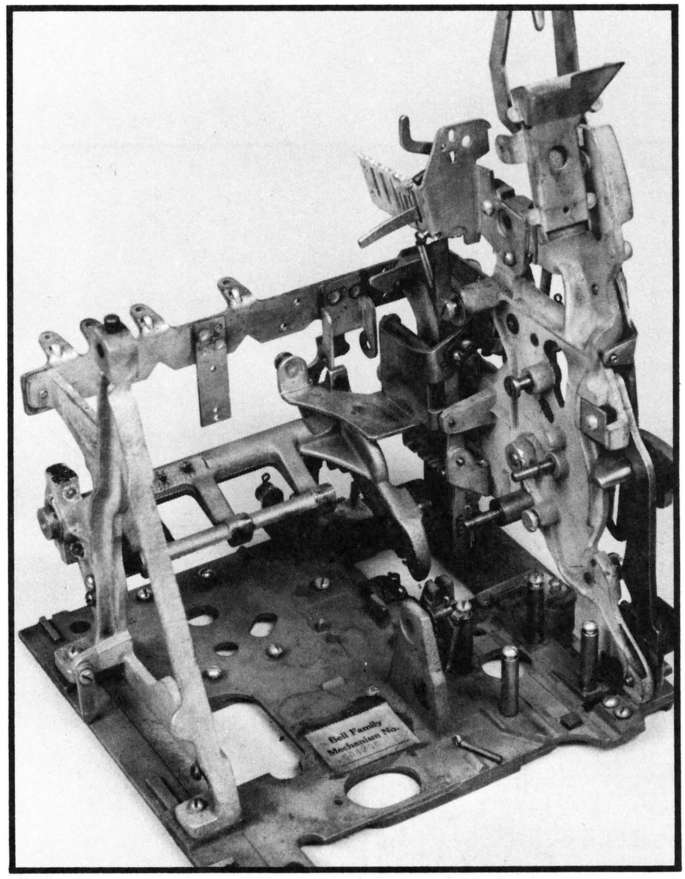


Figure 7.40

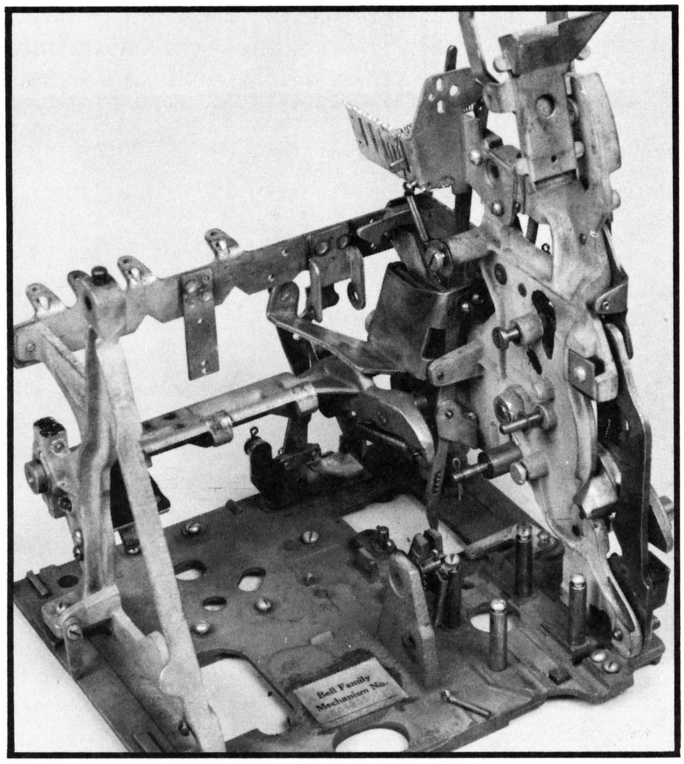


Figure 7.41

Cocking of the Vertical Payout Levers

Figure 7.39 shows the vertical payout pushback lever assembly above, a vertical payout lever and its two corresponding mounting brackets. It is the function of the pushback assembly to remove the vertical payout levers from the reel assembly during the wind-up cycle in order that the reels may spin freely until they are stopped and sensed for possible winning payoff combinations.

Figure 7.40 shows the vertical payout pushback lever assembly installed on the frame, as well as one of the vertical payout levers and its corresponding brackets.

When the mechanism is in its ready position, the pushback assembly rests against a bar extending from the operating fork and it is this interface that is responsible for the motion of the vertical payout pushback assembly when the operating fork rotates during the wind-up cycle of the machine. The relative motion of the main operating fork and the pushback assembly can be seen by observing Figure 7.41. In this wound up position, the vertical payout lever has been moved to the right and withdrawn from where the reel discs themselves would be. The vertical payout lever pushbar assembly is held in this cocked position by one of the timing levers on the rear of the machine, which is not shown in this figure since it will be covered later in this chapter. What is being shown here is the action involved in the movement of this assembly by the main operating fork. The release of the assembly will be covered later.

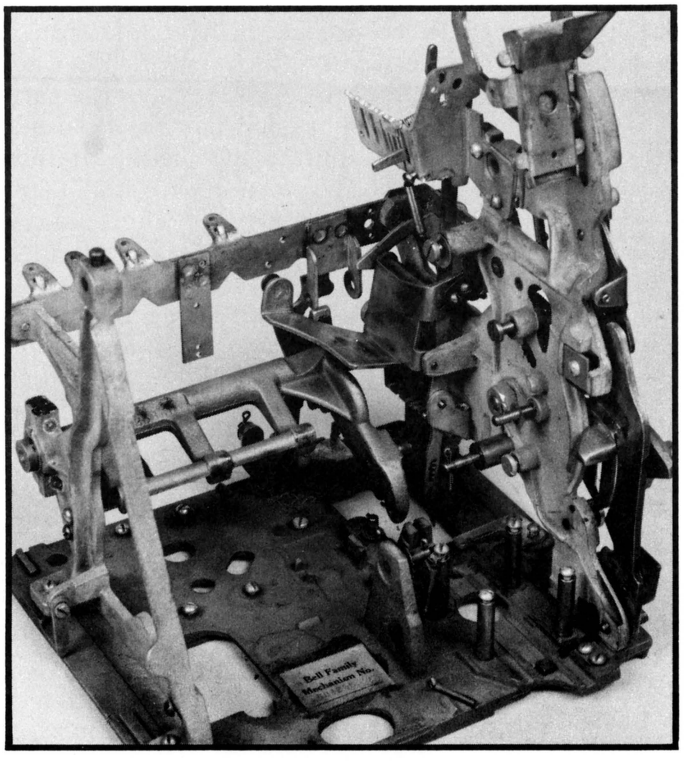


Figure 7.42

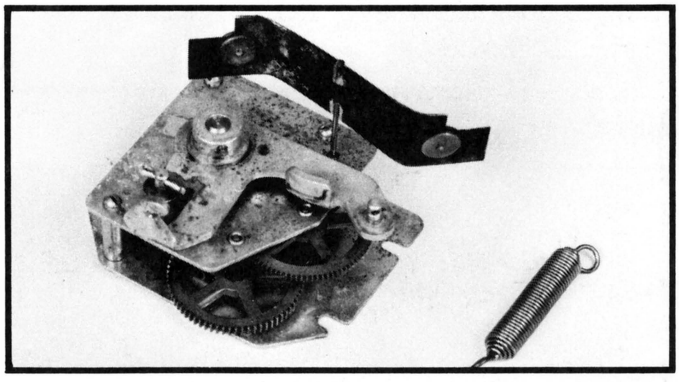


Figure 7.43

Figure 7.42 shows an important feature which was described previously when the theory of the check detection and payout system was discussed. In Figure 7.42 the anti-check payout control lever is now wrapped around the end of this pushback assembly and prevents it from returning to the normal position. It is this action that inhibits payout when a token is sensed.

Winding Up The Clock

Figure 7.43 shows the clock assembly and the clock spring before installation into the mechanism. When the main clock arm is rotated in a counter-clockwise direction, it is free to travel due to the ratcheting action of the dogs on the main gear ratchet. When the main clock arm is rotated in a clockwise direction, its ratchet engages the main gear dogs, and the succeeding gear train drives the clock fan which acts as a governing agent. It is this governing action by the fan which controls the rate of speed of the clock in its

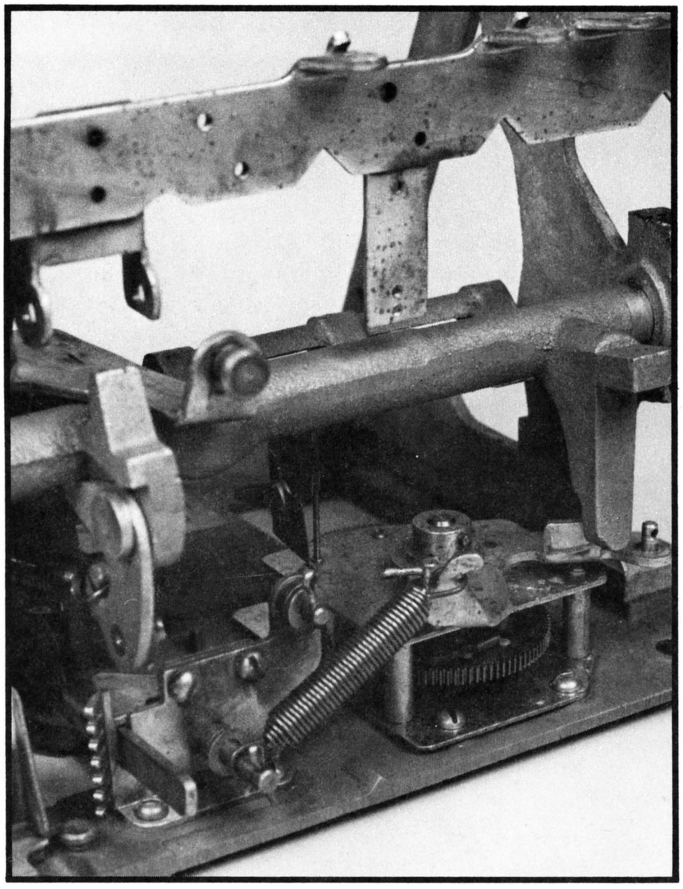


Figure 7.44

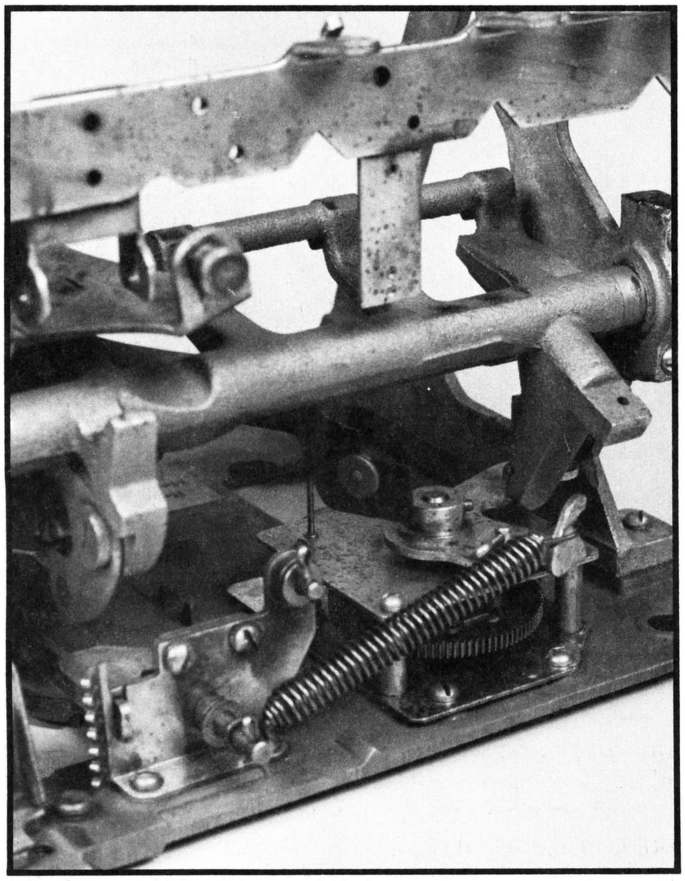


Figure 7.45

clockwise direction and thus controls the rate of speed of the unwind cycle. This section is connected only with the explanation of the wind-up and the unwind-

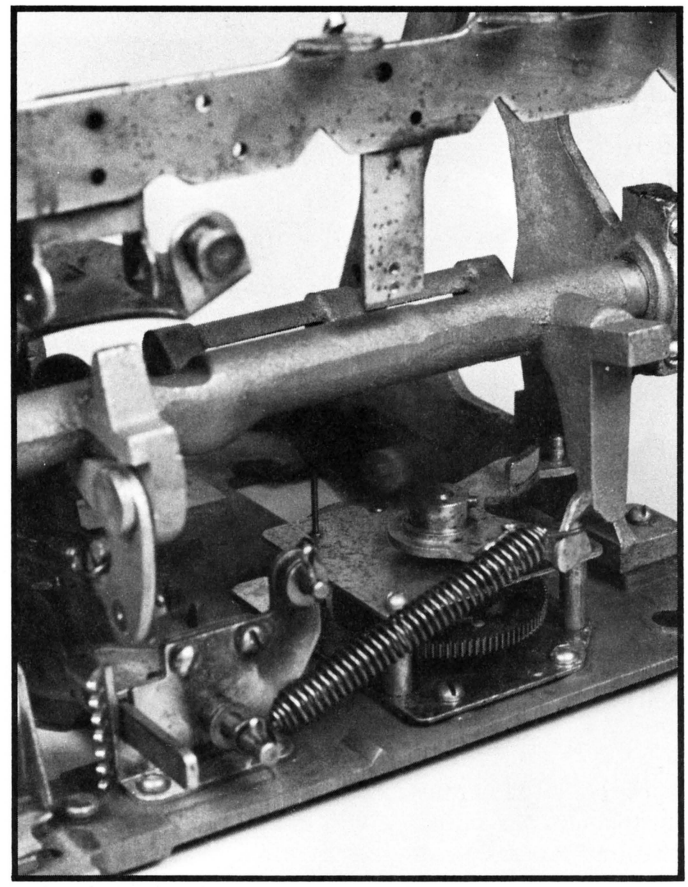


Figure 7.46

ing of the clock.

Figure 7.44 shows the installation of the clock and the clock spring into the mechanism. The clock spring is temporarily connected to the frame in order to demonstrate the action of the clock, because the part to which it is normally connected has not been installed and would only confuse the picture at this point in the explanation. The position of the main operating arm on the clock as shown in Figure 7.44 represents the clock in its fully unwound or ready position. As the main operating lever begins its wind-up cycle, the main operating fork is rotated in such a manner as to begin to wind the main operating arm of the clock in a counter-clockwise direction as shown in Figure 7.45. After the main operating lever releases the main operating fork, and the fork returns to its ready position, the clock is then free to begin its unwind cycle as fast as the governing action of the clock fan will permit. This action, the unwinding (notice the spinning fan blade) of the clock, is shown in Figure 7.46. It is during this unwind cycle of the clock that various functions are performed by the other assemblies in the mechanism, via the two timing linkage bars.

Review of the Theory of Operation

Until now, the theory of operation has concerned

itself with the wind-up and release cycles of the mechanism as performed by the main operating lever and the main operating fork. The functions performed by the operating lever during its wind-up cycle have been detailed one at a time. The main operating fork was then examined and each of the wind-up functions which it performed were examined, in detail, with their associated parts. Finally, the clock was shown incorporated in the mechanism being wound up by the operating fork. Up to this point, all of the direct wind-up functions associated with the operating lever

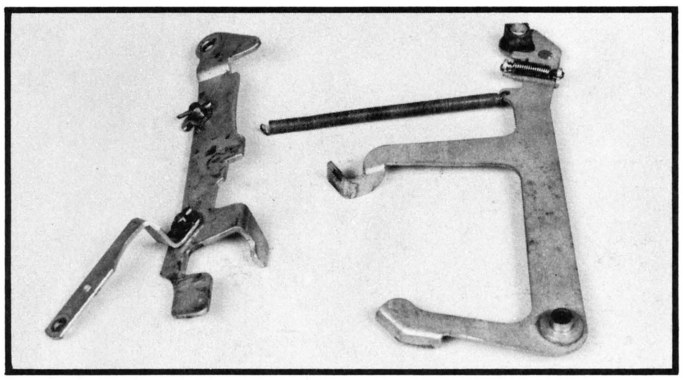


Figure 7.47

and the operating fork were explained. There are, however, additional wind-up functions associated with the winding-up of the main operating arm of the clock. The remainder of this chapter will be devoted to these additional wind-up functions and the functions and tasks that take place during the unwind

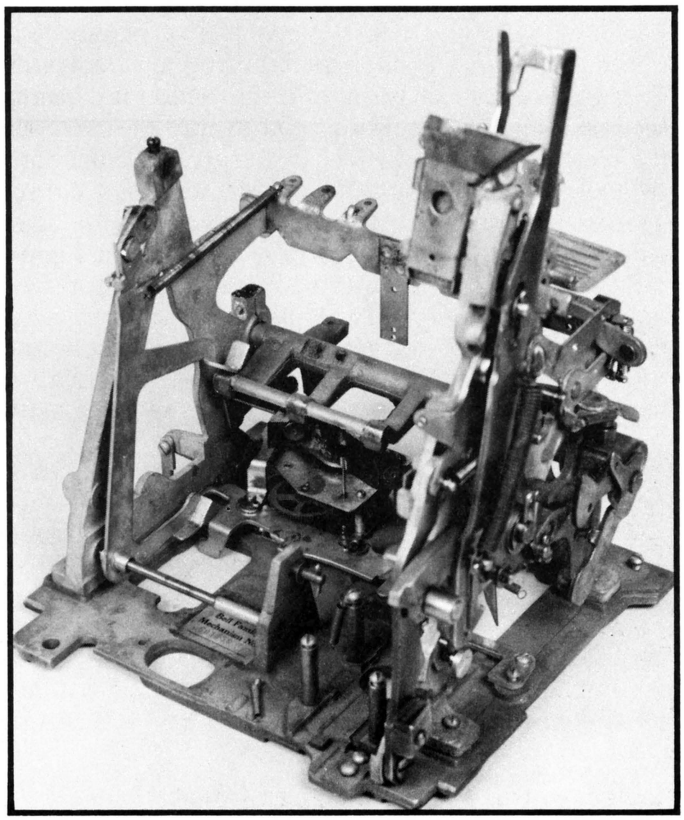


Figure 7.48

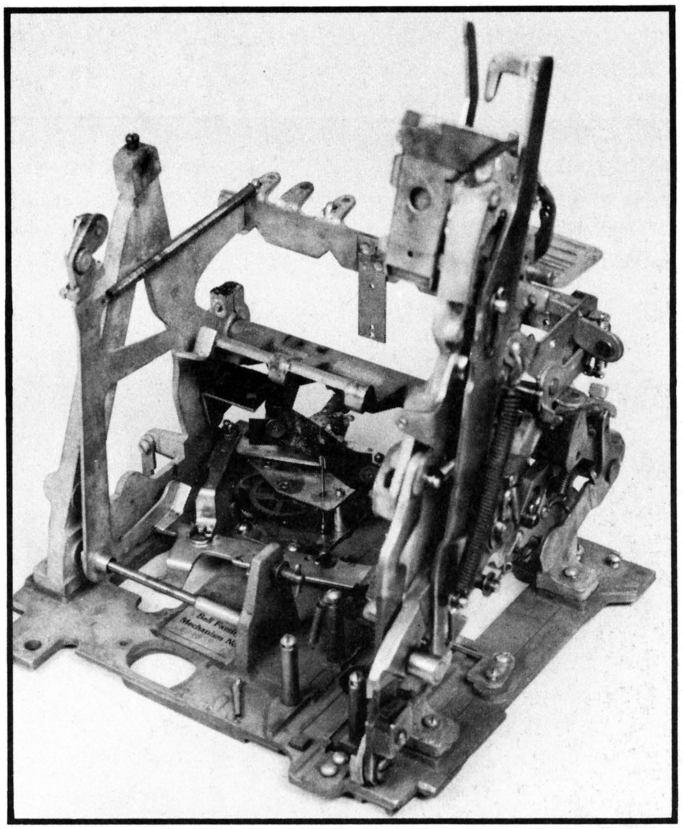


Figure 7.49

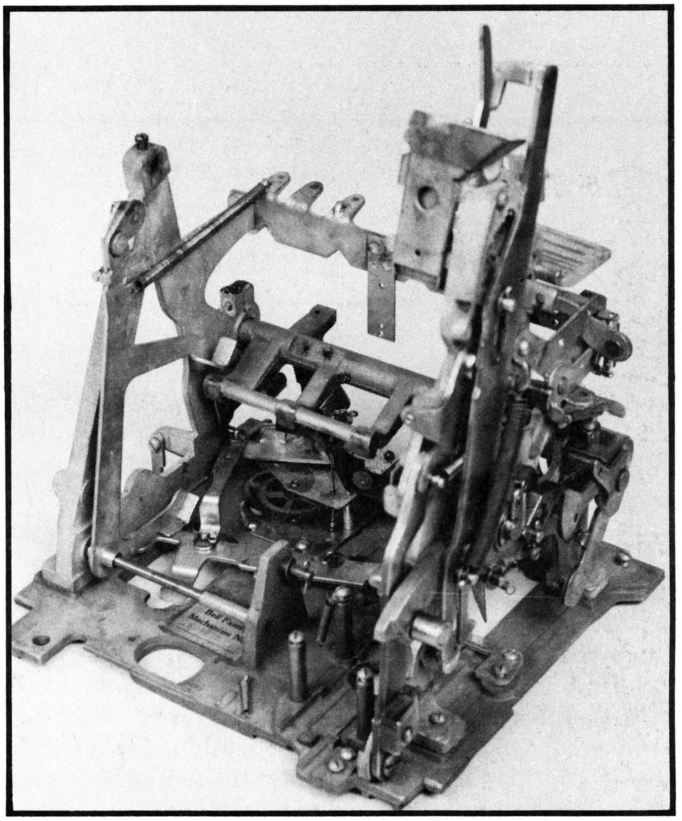


Figure 7.50

cycle of the mechanism.

Some of the tasks to be performed during the unwind cycle of the mechanism need to be performed in

precise sequence, and because of this, they are considered to be part of a "timing" process. It is important to understand how each specific task or function is performed during the unwind cycle as well as when the function is perfomed. It cannot be over emphasized that understanding each particular function and how it is accomplished is absolutely imperative to successful troubleshooting and/or repairing of the mechanism.

Operation of the Reel Stop Levers

Figure 7.47 shows the reel timing lever assembly

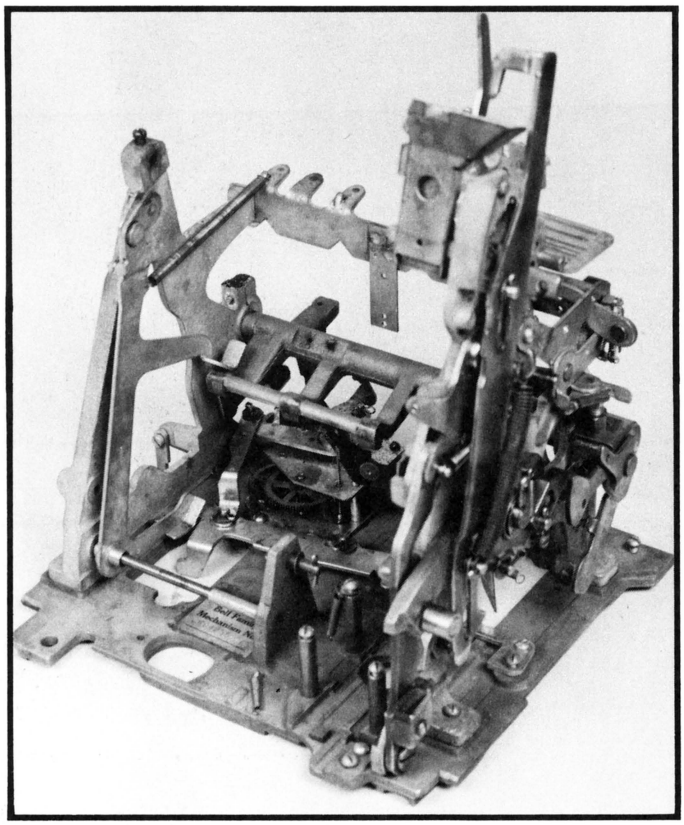


Figure 7.51

and its linkage bar on the left with one of the reel stop levers on the right to be used for illustration. It is the function of the reel timing lever assembly to properly sequence the three reel stop levers in succession to stop each of their corresponding reels. Figure 7.48 shows these parts installed in the frame of the mechanism at the beginning of the wind-up cycle. By the end of the wind-up cycle, the reel stop lever has been fully retracted from the reel and appears in a full forward position as shown in Figure 7.49. It should be noted that the lifting action of the reel stop lever during the wind-up cycle is provided by the main operating fork and while this action is occurring, the reel timing lever assembly is simultaneously being moved forward and positioning itself under the bottom foot of the reel stop lever, but at this moment, does not make contact with it.

After the main operating fork has been released by the main operating lever, the reel stop lever is pulled

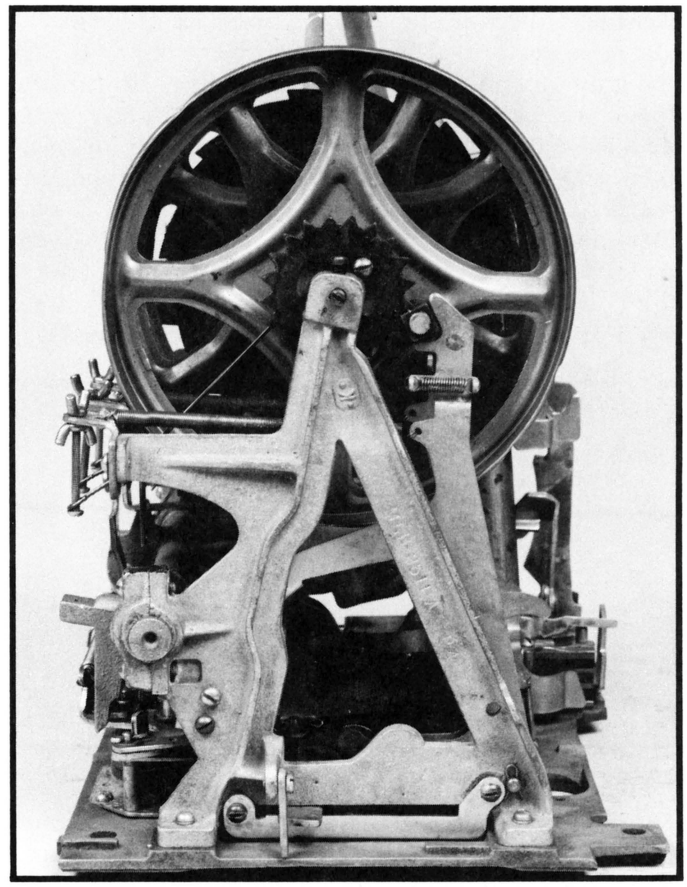


Figure 7.52

back toward the reel assembly by its extension spring and will be stopped by the reel timing lever assembly as shown in Figure 7.50. Notice that as the clock continues to unwind, it pulls the reel stop lever towards the rear of the mechanism and thus gradually begins the lowering of the reel stop lever toward the center of the reel. Eventually the reel stop lever will come into contact with the starwheel on the reel hub, subsequently stopping it (the reel assembly, with starwheels, is not shown for clarity) as shown in Figure 7.51. At the end of the unwind cycle the reel stop timing lever no longer makes contact with the reel stop lever and the reel stop lever is left touching only the starwheel on the reel hub as shown in Figure 7.52.

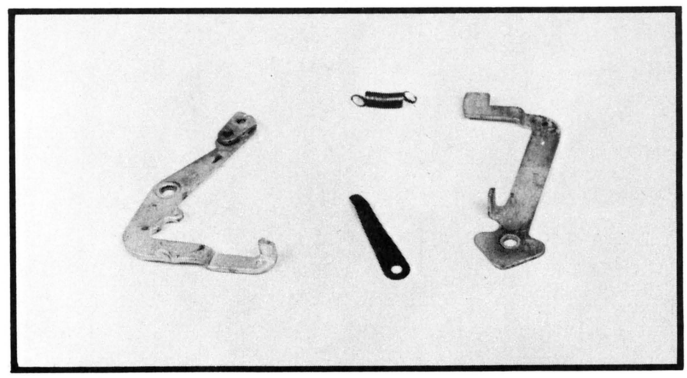


Figure 7.53

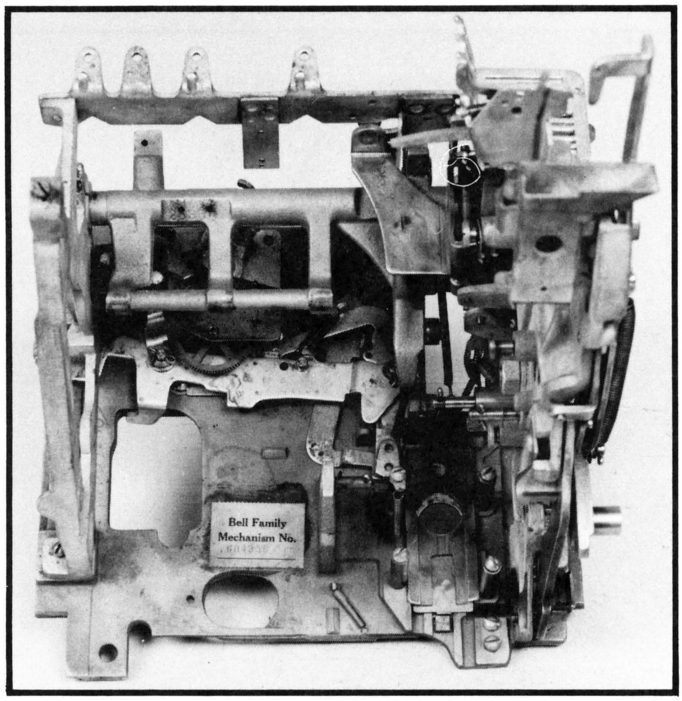


Figure 7.54

Locking and Releasing the Payout Slides

Figure 7.53 shows the payout slide lock lever on the left and the payout slide stop lever on the right with an extension spring and copper tension plate. It is the

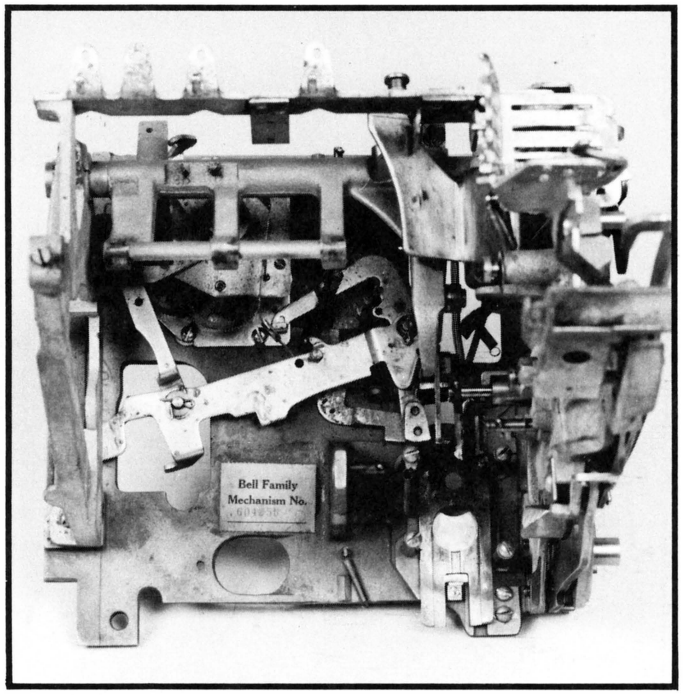


Figure 7.55

function of the payout slide lock lever to lock the master payout slide in the forward position during the wind-up cycle of the mechanism such that it cannot be pulled back into the mechanism. After the mechanism enters into its unwind cycle, this lever is then pulled back away from the master payout slide allowing it and the other slides to be released if winning combinations have occurred on the payout line of the reels.

Figure 7.54 shows the payout slide lock lever installed in the mechanism with the master payout slide to demonstrate the interaction of this lever with the slides. As the mechanism is wound up, it will be no-

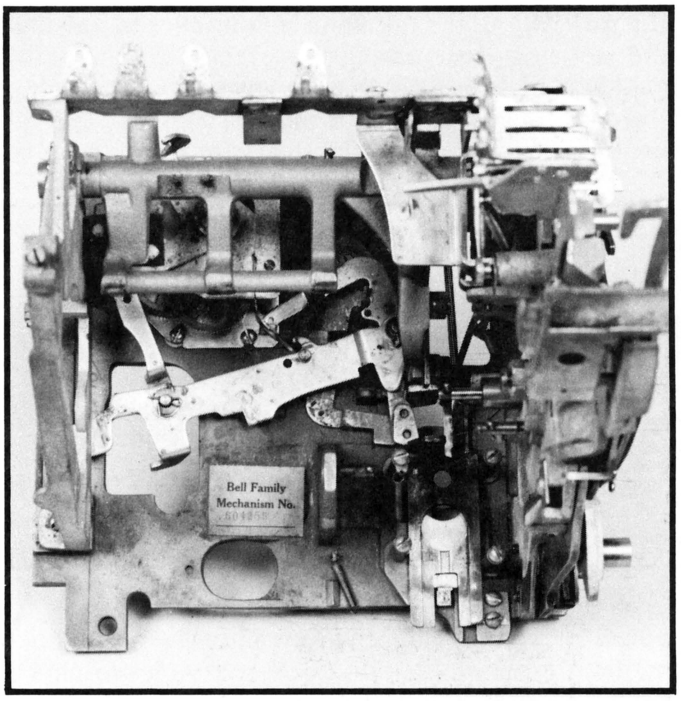


Figure 7.56

ticed that the payout slide lock lever moves itself into position behind the master payout slide as shown in Figure 7.55. This motion is caused by the movement of the reel stop lever timing bar through the extension

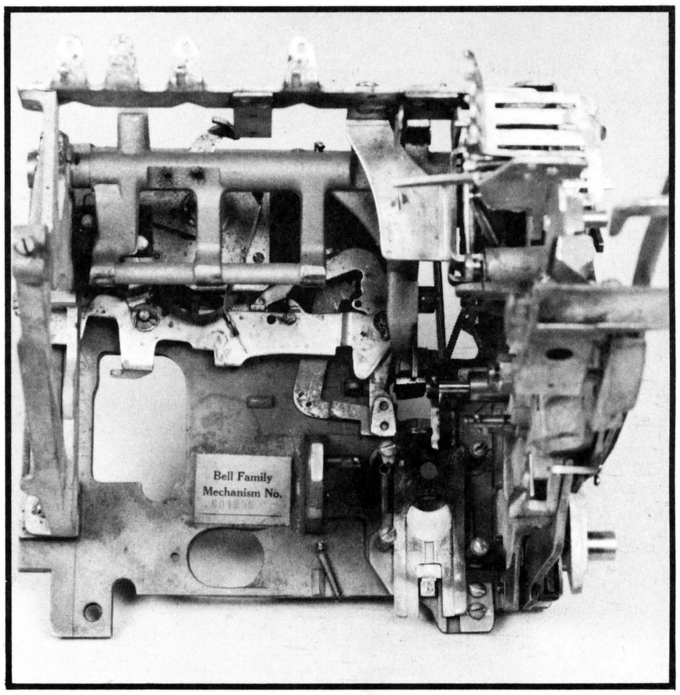


Figure 7.57

spring connected to it and the payout slide lock lever.

After the mechanism has completed its wind-up cycle and the operating fork has been released from the operating lever, the payout slide pushbar retreats from the master slide, allowing these slides to be pulled back into the mechanism; they are now stopped by the payout slide lock lever as shown in Figure 7.56. As the mechanism continues to unwind, the reel stop lever timing bar eventually causes the payout slide lock lever to move away from the slides, thereby allowing them to be released as shown by Figure 7.57. At this point, the slides are now free to be

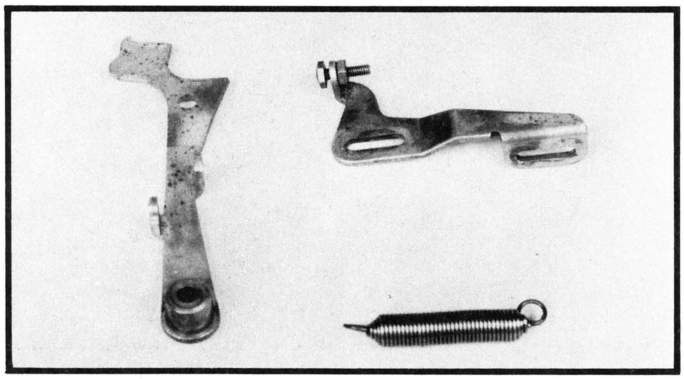


Figure 7.58

pulled back into the mechanism and are stopped only by the position of the horizontal payout levers which will be described later in this chapter.

The payout slide stop lever shown on the right in Figure 7.53 has a minor maintenance function. When

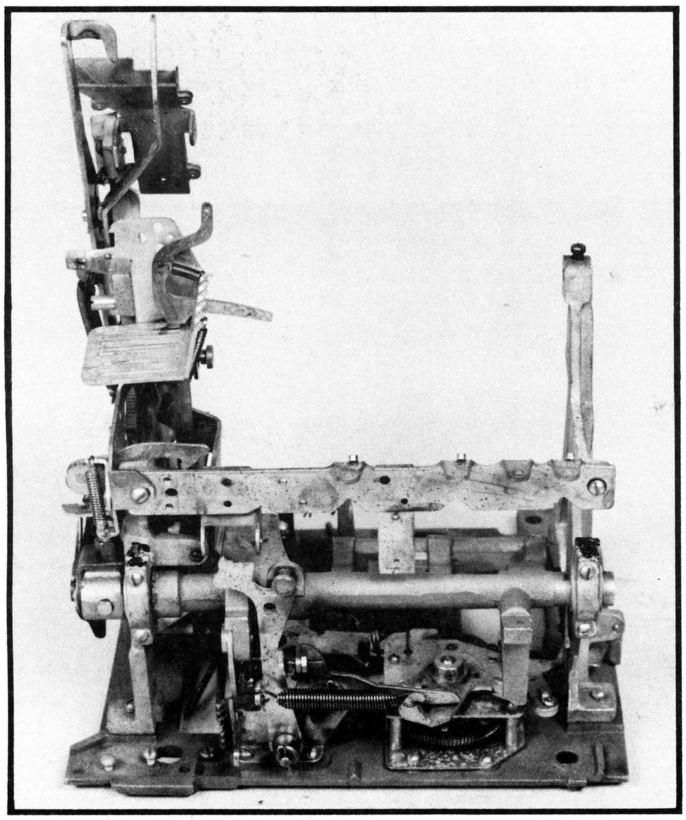


Figure 7.59

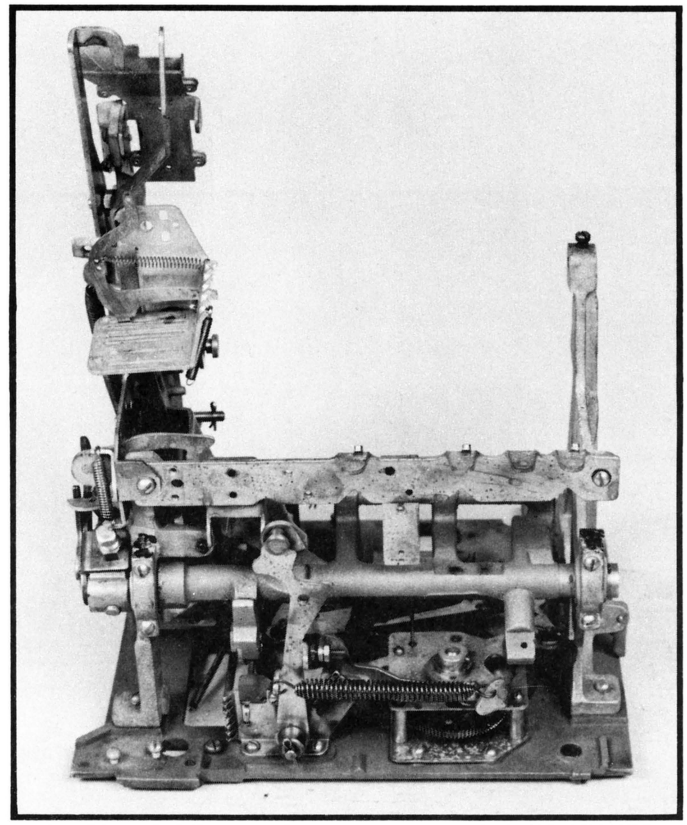


Figure 7.60

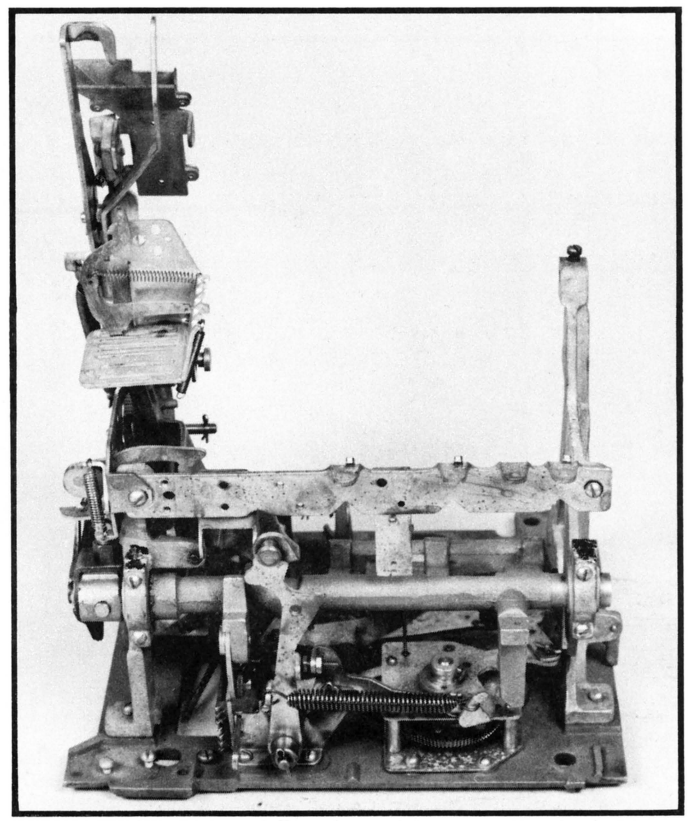


Figure 7.61

the mechanism has completed its cycle, if the master slide is manually pushed forward, this slide may be manually pulled in behind it, thereby keeping the ten-

sion of the slides off of the horizontal payout levers, permitting easy removal or checkout of them. When the mechanism is recycled again, the payout slide lock lever will automatically pull this stop lever out of the way and put it in a stow position under the copper tension plate for future plays. As mentioned previously, this is a minor part used for a special form of maintenance and is non-essential for both the operation of the mechanism and almost all maintenance situations.

The Release of the Vertical Payout Levers

Figure 7.58 shows the timing lever on the left and the adjustable timing lever link on the right along with the clock spring (see Appendix A for earlier mechanisms). It is the function of the timing lever to hold the vertical payout levers, via the pushback lever, in their cocked position during the unwind cycle until the reels have stopped spinning. After the reels have stopped spinning, the vertical payout pushback lever is allowed to drop, thus releasing the payout levers. The timing of this lever is accomplished by means of the adjustable timing lever link which is connected to the clock.

Figure 7.59 shows the timing lever, its link and spring installed on the mechanism. Notice the position of the vertical payout lever and the payout pushback lever corresponding to the mechanism's ready or beginning position. Figure 7.60 shows the position of the timing lever after the mechanism has been fully wound up, but the main operating fork has not been released. In the wind-up cycle, the operating lever has wound up the clock causing the timing lever to slip

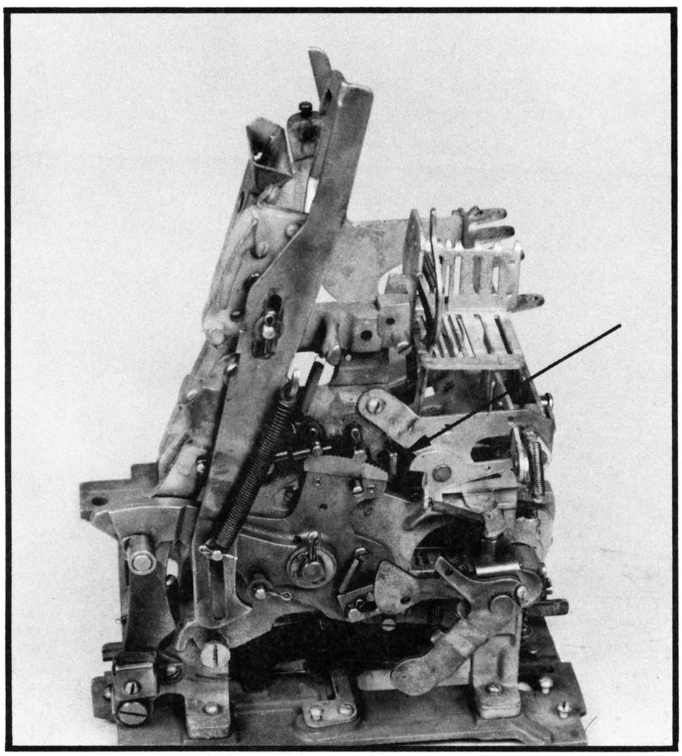


Figure 7.62

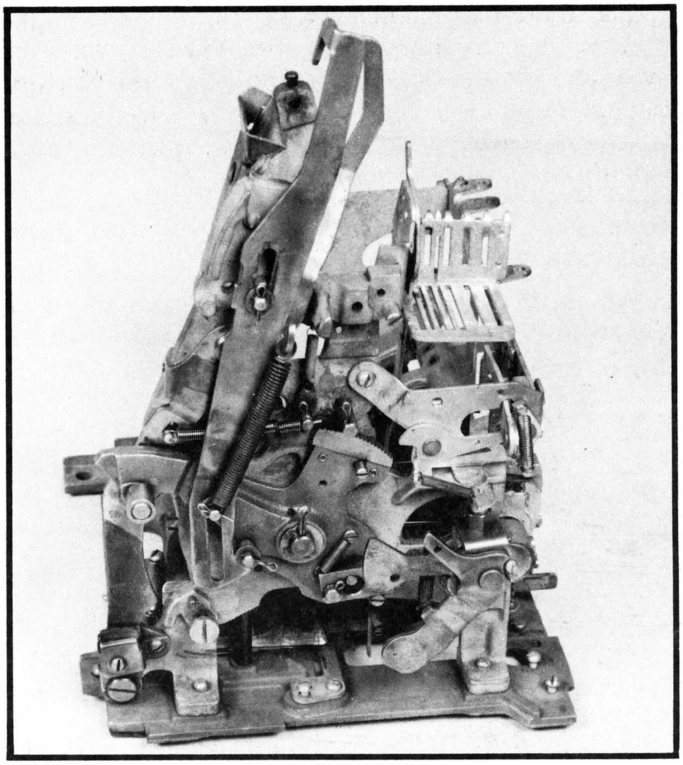


Figure 7.63

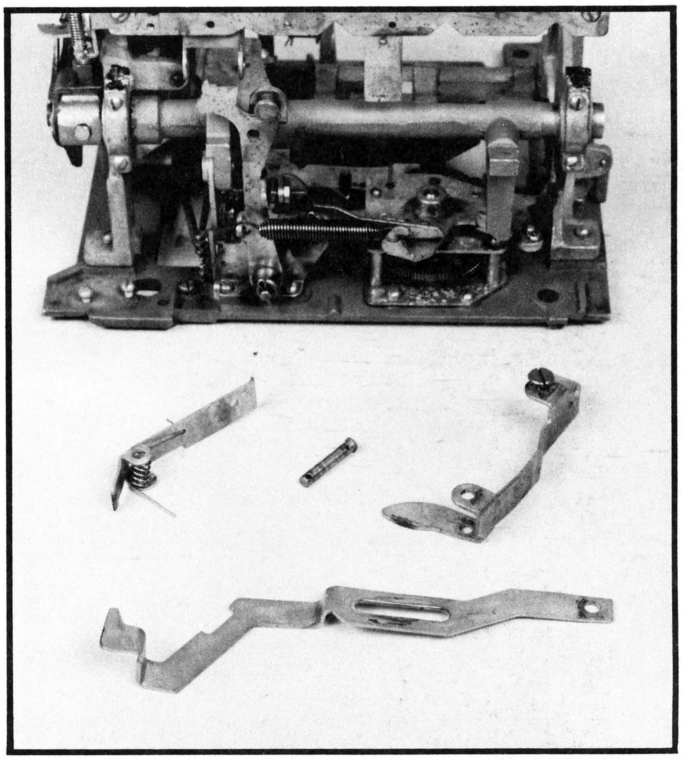


Figure 7.64

underneath the payout lever pushback lever which has been raised by the operating fork.

Figure 7.61 shows the mechanism just after the operating fork has been released. Notice that the vertical payout lever is still retracted away from the reel disc and the pushback lever is being held upwards by the timing lever. As the clock continues to unwind, the

timing lever is gradually pulled to the left and eventually allows the vertical payout pushback lever to be released downward, thereby releasing the vertical payout levers. The adjustment on the link allows the payout levers to be released at the proper time after the third reel has had time to stop.

Release of the Main Operating Lever During the Unwind Cycle

After the main operating lever has completed its wind-up cycle and has been released, it will not return to its ready position, it will return partially and then stop as shown in Figure 7.62. The operating lever is held in this position by a portion of the vertical payout pushback lever assembly which protrudes through the frame from the other side and catches the operating lever as shown by the arrow. The reason for holding the main operating lever in this position is to prevent the escalator from completing its cycle until the operating cycle of the mechanism itself has been completed. After the vertical payout pushback lever assembly has been released by the timing lever, the operating lever arm is then free to travel the rest of the way, back to its ready postition, as shown in Figure 7.63.

Reel Disc Levers

Figure 7.64 shows the disc stop lever on the left, the award token release lever on the right and the award

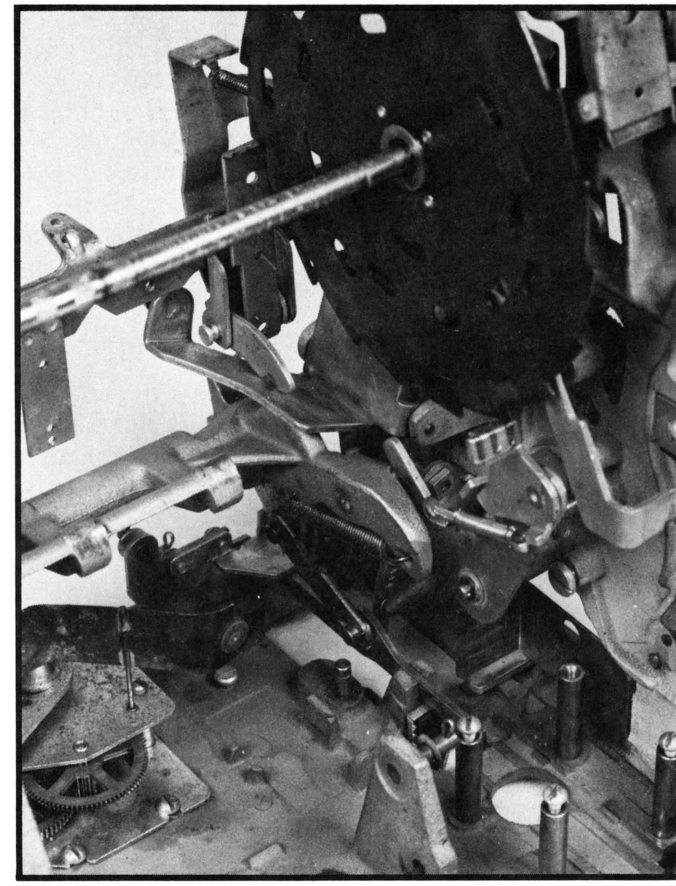


Figure 7.66

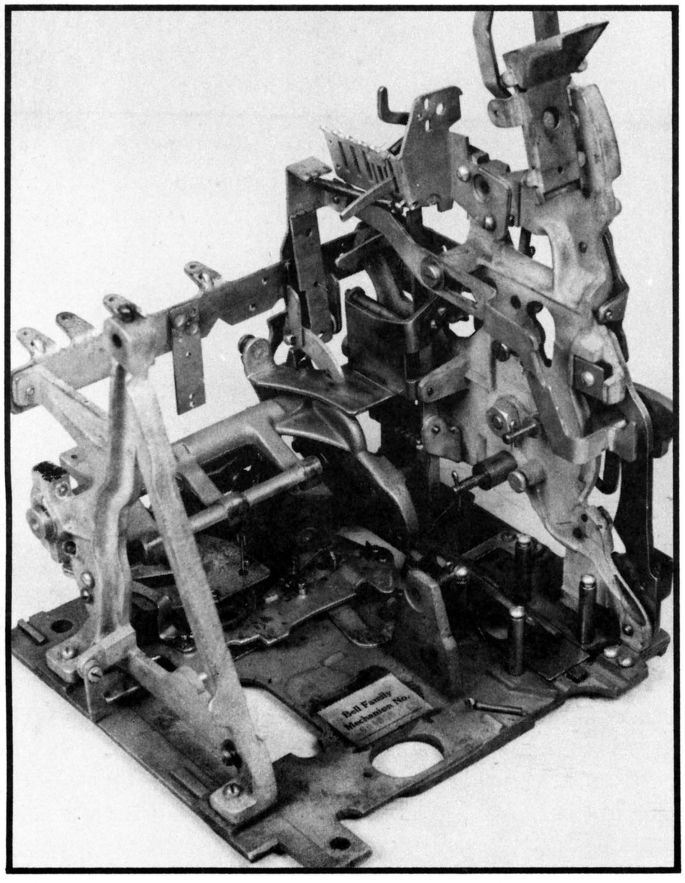


Figure 7.65

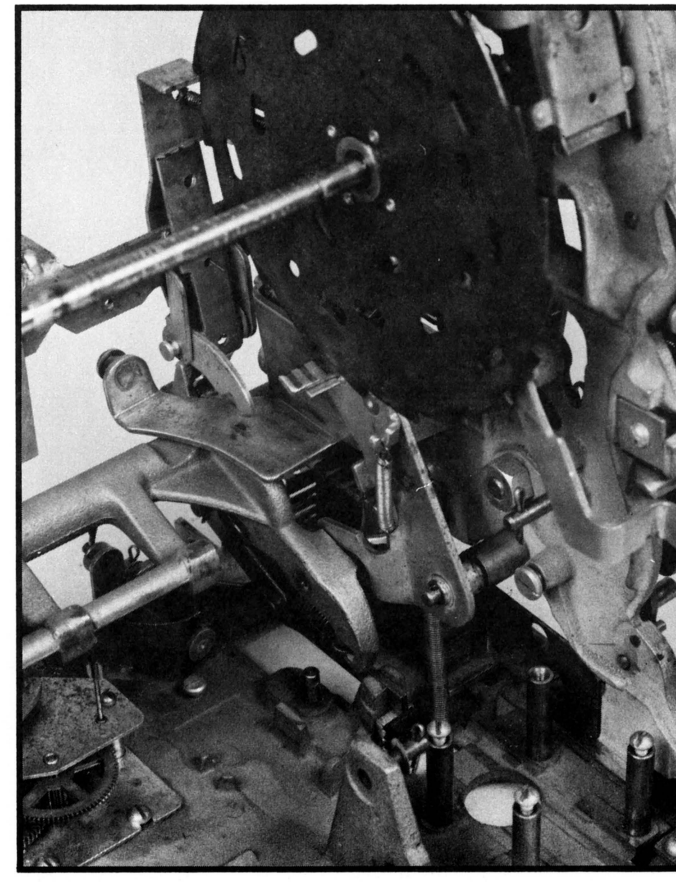


Figure 7.67

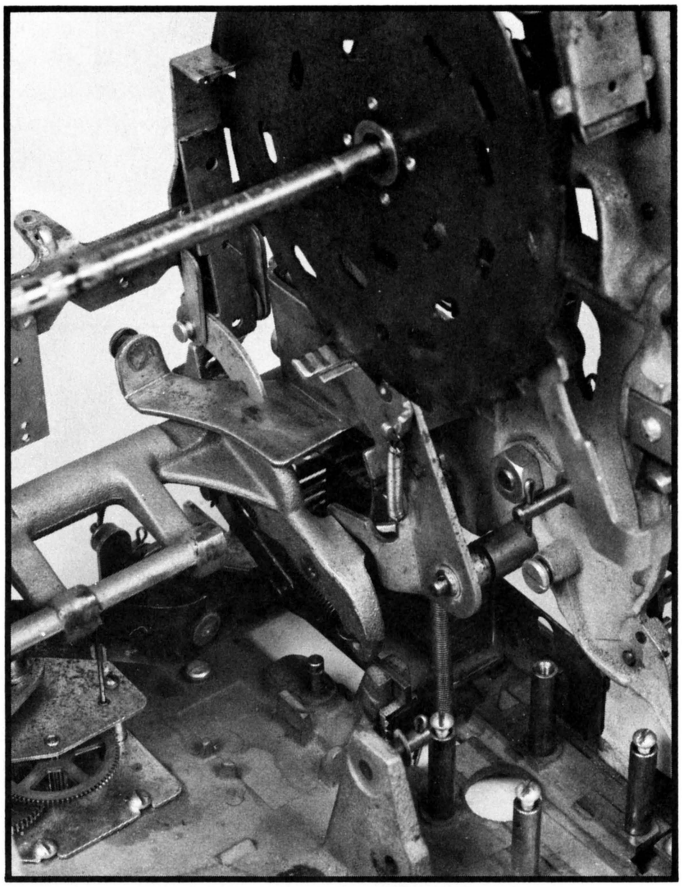


Figure 7.68

token release pushbar at the bottom. It is the function of the disc stop lever to prevent the reels from spinning backwards during the windup cycle of the mechanism. It is the function of the award token release lever and award token release pushbar to sense when three sevens appear on the reels and thus dispense the special award token.

Figure 7.65 shows these levers and bar installed on the frame of the mechanism. While these two disc levers are coaxially located on the same pin, each serves a totally different function and will therefore be explained separately.

The award token release lever is operated by the vertical payout pushback lever and is shown in its normal position in Figure 7.65. As the mechanism goes through its wind-up cycle, the payout pushback lever and its award token release lever are drawn toward the rear of the mechanism as shown in Figure 7.66. After the mechanism has gone through enough of its unwind cycle to release the vertical payout levers, the award token release lever will simultaneously be released and thrust forward due to the tension on the spring attached to it. If the reels have stopped in a position other than the notch, as shown in Figure 7.67, then the forward motion of the award token release lever will be prevented by the discs, and thus, no special award token will be released. If the notch in the reel disc has stopped such that it is in front of the award token release lever, then the award token release pushbar can continue forward to its maximum forward position, as shown in Figure 7.68, thus triggering the award token release mechanism located on the inside front of the case. It should be noted that all three discs must have their notch in the correct position in order for the award token release pushbar to travel forward, corresponding to all three sevens on

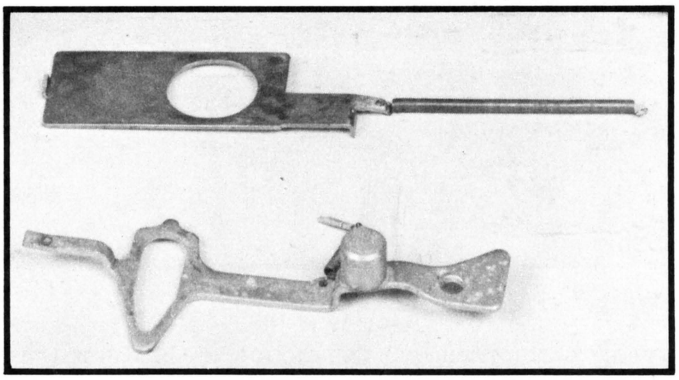


Figure 7.69

the payout line.

The action of the reel disc stop lever can best be seen by referring to Figure 7.67 which shows it being held in the backward position by the main operating fork. Figure 7.66 shows the disc stop lever being pressed against the reel disc as the main operating fork is rotated during the wind-up cycle of the mechanism. While the reel disc stop lever is in contact with the reel disc, it is impossible for the disc to spin in the reverse direction. While the mechanism is being wound up, the reel operating assembly is attempting to push the discs in the opposite direction, but rotation is prevented due to the action of the disc stop lever. When the main operating fork releases the reel operating lever (kicker), it simultaneously moves the disc stop lever away from the discs, allowing them to spin without interference. It is this action that is the purpose of the disc stop lever, namely to prevent any backward rotation of the reels due to motion of the reel operating lever (kicker) assembly during the wind-

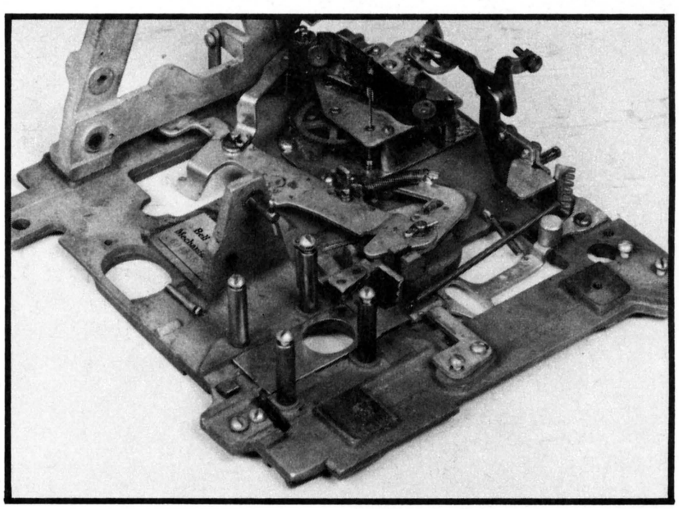


Figure 7.70

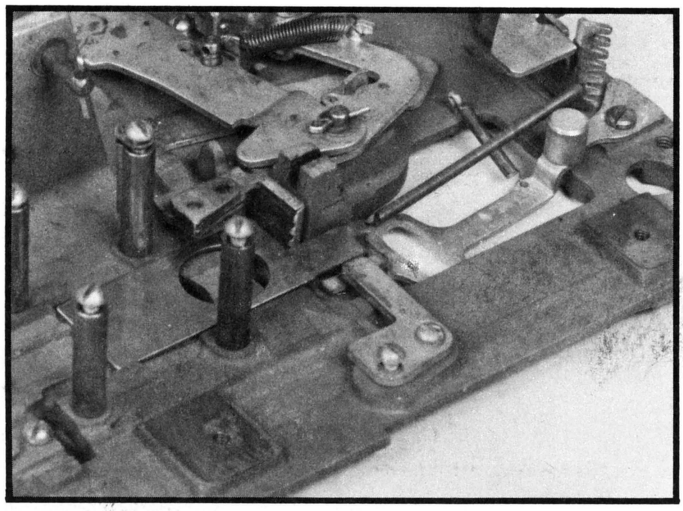


Figure 7.71

up of the mechanism. This action also assures that the saw-shaped teeth of all three discs are in line, thus presenting a straight line of teeth for uniform contact with the reel operating lever once it engages them to start their spinning.

For machines without special award token dispensers, these parts take on a different and more simple configuration, but they still perform the same disc stop function.

Safety Slide Operation

Figure 7.69 shows the safety slide and the safety slide lever assembly. The safety slide is sometimes also referred to as the "non-beating" mechanism. It is the function of the safety slide to prohibit the dispensing of coins if the mechanism has been severely jarred during its operational cycle. The best analogy to draw here is basically that of the tilt on a pinball machine. The safety slide accomplishes this task due to the inertia weight placed at the end of the safety slide lever which accounts for the triggering of the safety slide itself.

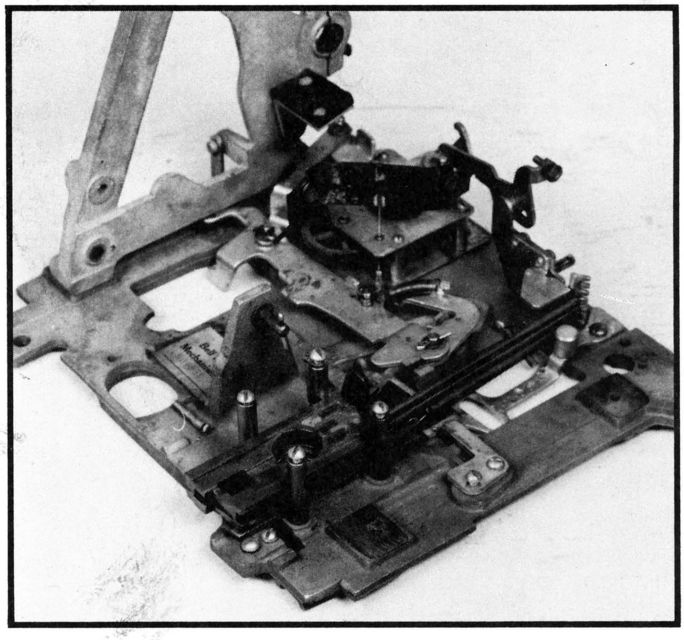


Figure 7.73

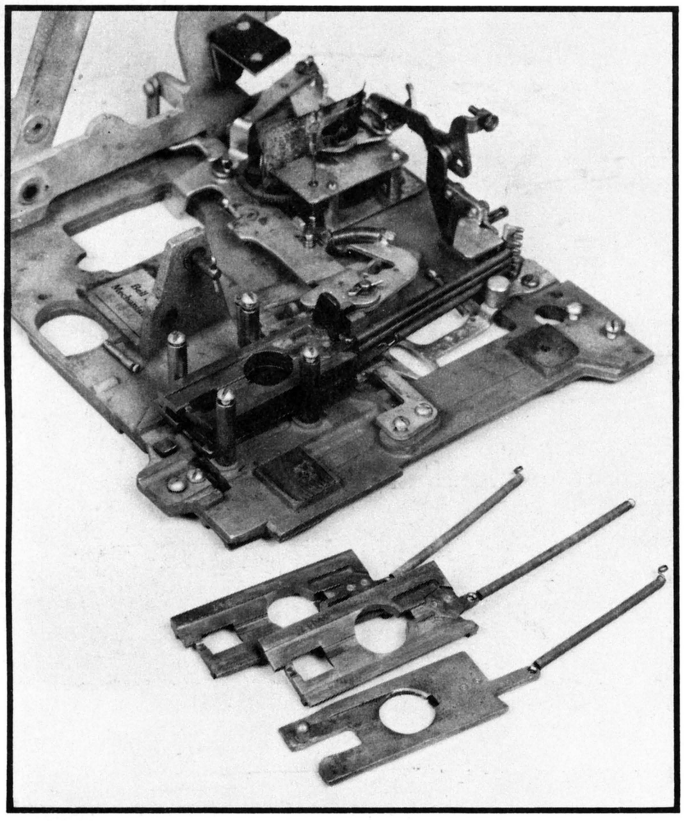


Figure 7.72

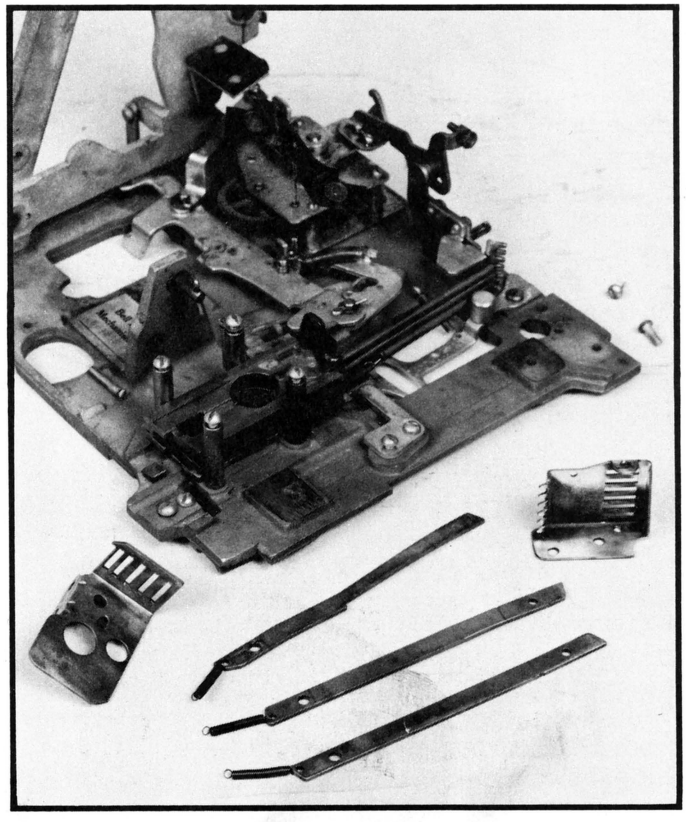


Figure 7.74

Figure 7.70 shows the installation of the safety slide and the safety slide lever in what would be their normally cocked position. It should be noted that each time the mechanism is cycled, the payout slide pushbar resets the safety slide to the position shown in Figure 7.71. When the mechanism is jarred sufficiently during its operational cycle such that the safety slide lever is moved toward the clock, then the safety slide itself will be free to slide toward the rear of the mechanism thus closing the hole in the base of the mechanism and thereby preventing any coins from being released by the payout system. It should be noted that the extension spring attaching the safety slide lever to the frame provides a modest amount of tension to keep it in its normal position. It is not uncommon for the tension on this spring to weaken thereby causing the safety slide lever to allow the safety slide to close after each operation, thus preventing payoffs. This is a common cause of payout malfunction and should be one of the things to be checked when there are no payouts, yet the rest of the mechanism seems to be operating correctly.

The Payout Slides

Figure 7.72 shows the master and two other payout slides installed in the mechanism between their service posts and the remaining payout slides laying next to them. The payout slides are positioned in the mechanism as shown with their springs connected to the rear mounting bracket. The payout slides have two positions, namely the rear or released position as shown in Figure 7.72 and the forward or cocked position shown in Figure 7.73. It is the function of the payout slides to move coins from the payout tube while in the

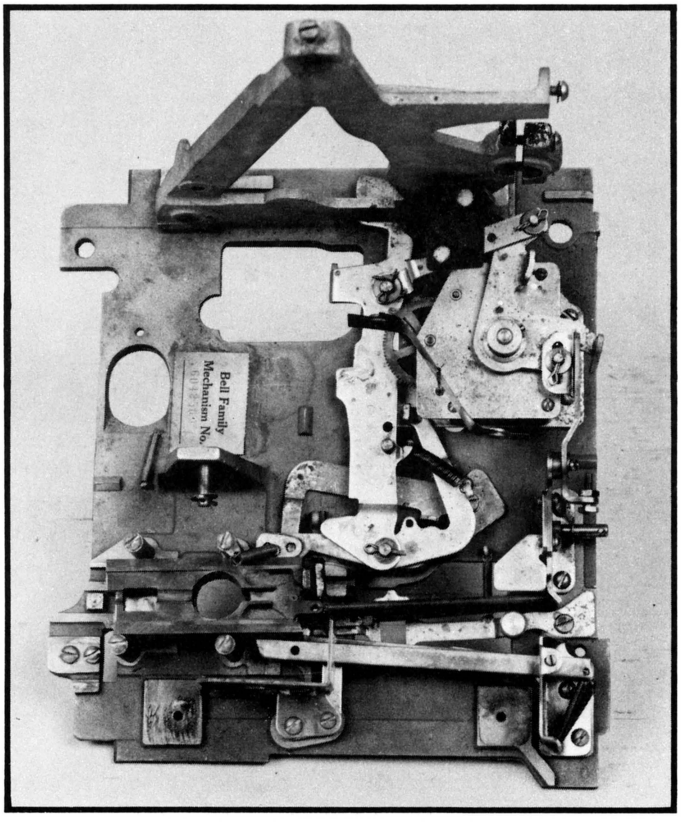


Figure 7.75

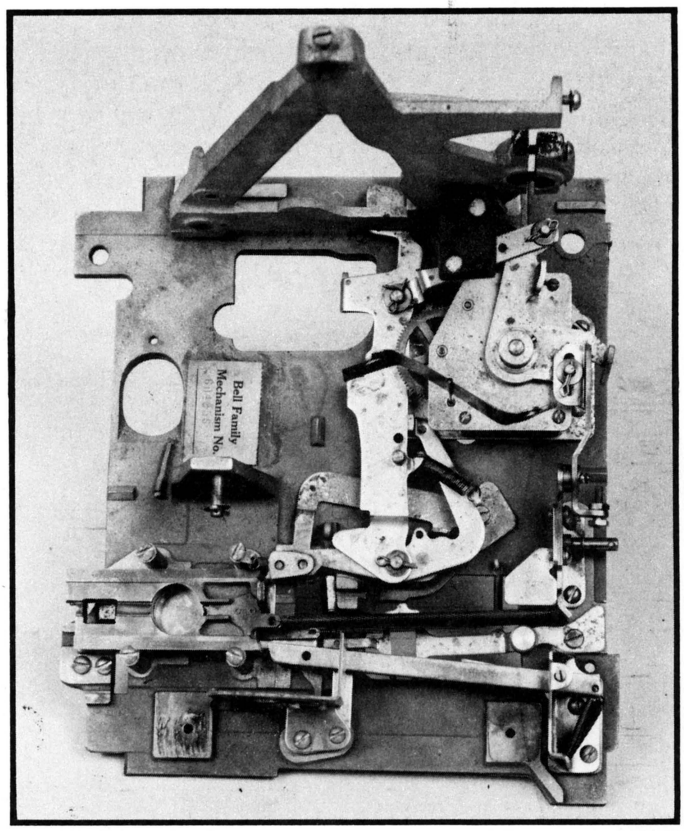


Figure 7.76

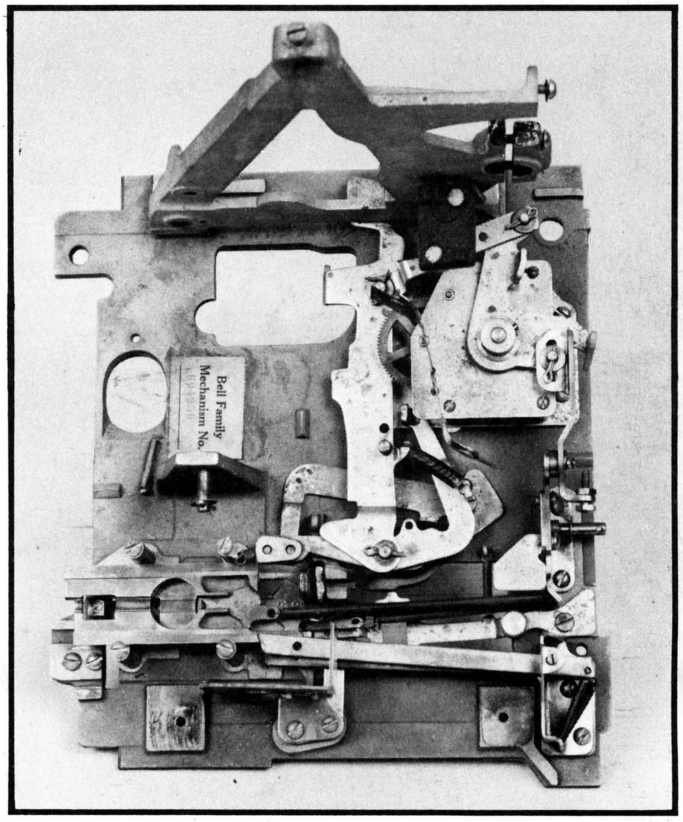


Figure 7.77

forward position to the payout hole in the rear position, thereby dispensing the coins to the player. The amount of coins dispensed is a direct function of the particular winning combination occurring on the payout line of the reels. The payout slides themselves each have a thickness corresponding to a certain number of coins. In this case, the master payout slide

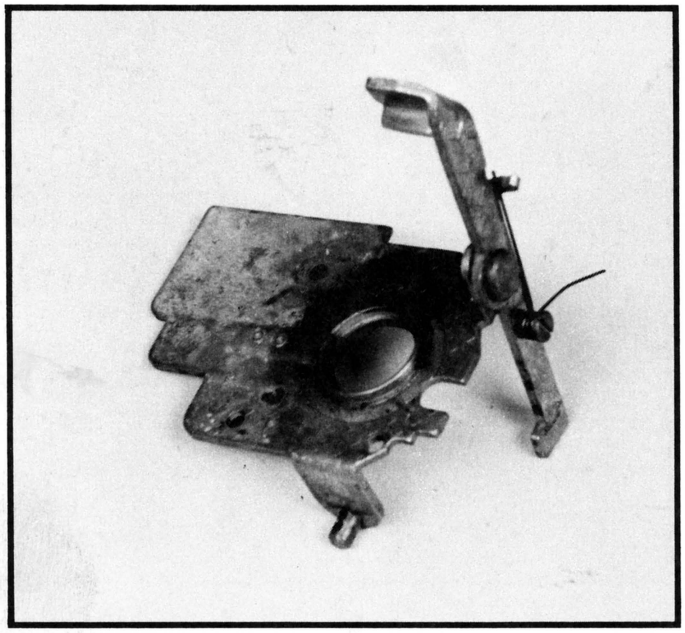


Figure 7.78

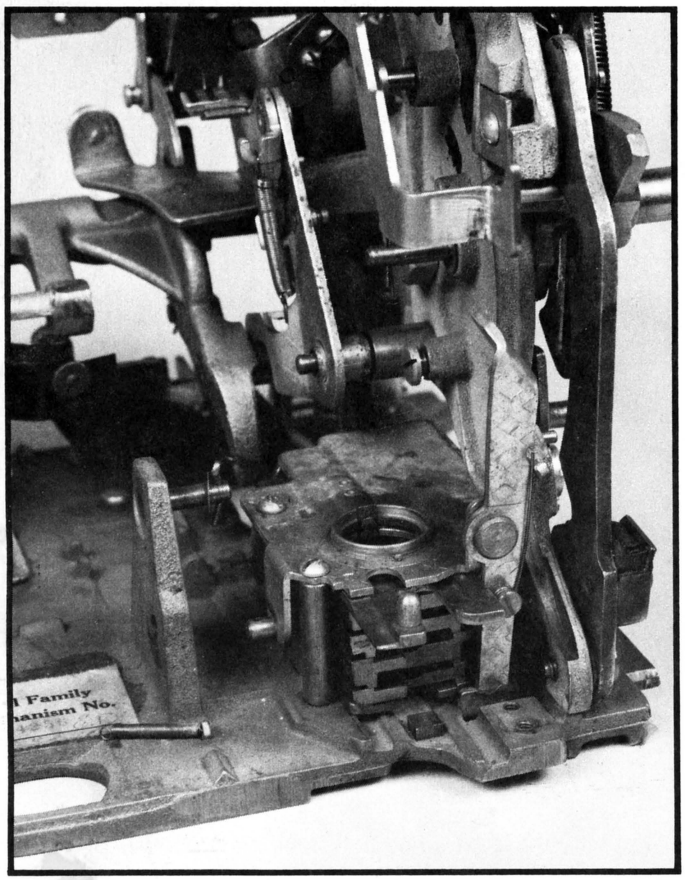


Figure 7.79

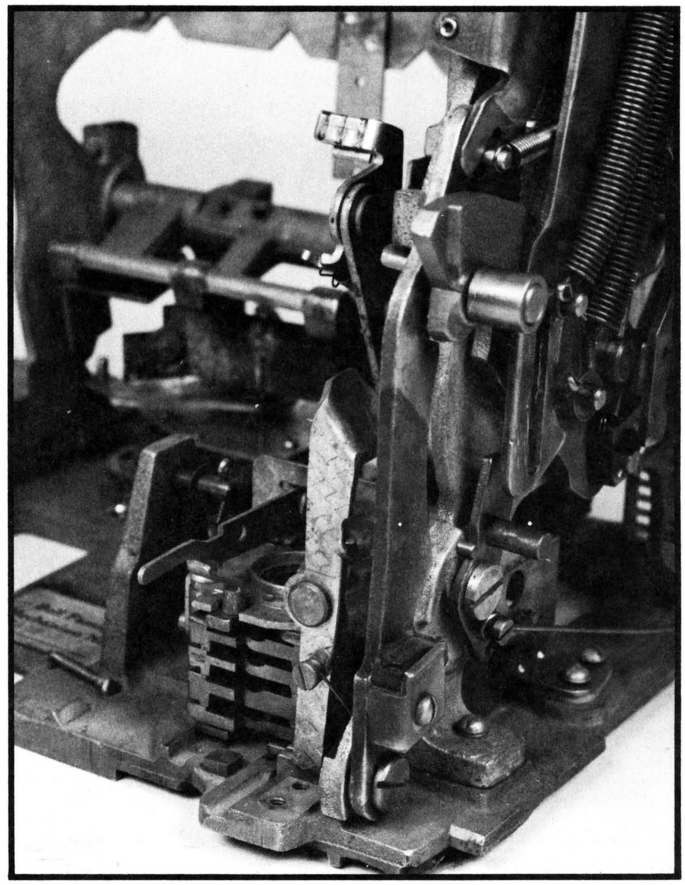


Figure 7.80

has a thickness of two coins, the next payout slide has a thickness of three coins and the next payout slide has a thickness of five coins. If the winning combination requires a payout of two coins, then the master slide containing two coins would be allowed to slide backwards. If the payout required a five coin payout, then the master slide containing two coins plus the next slide containing three coins would both be simultaneously moved from the forward to the rear position transporting a total of five coins to be dropped into the payout tray.

The control of which payout slides are permitted to move from the forward to the rear position during each mechanism cycle is performed by the horizontal payout levers, shown with their brackets in Figure 7.74. There are actually six payout levers used in this mechanism, but only three are used for illustrative purposes in order to keep the figures and explanation simple. Figure 7.75 shows these horizontal payout levers installed in the mechanism. Note the addition of the small extension springs at the ends of the horizontal payout levers which mount to the horizontal payout lever bracket. These springs provide the tension necessary to keep the horizontal payout levers normally rubbing against the sides of the payout slides.

Figure 7.76 shows the three slides in the forward position as they would normally be if there was no payoff at the end of a cycle. This example assumes

that the bottom two horizontal payout levers have been pushed outwards, as shown in Figure 7.77, and the top horizontal payout lever has remained where it

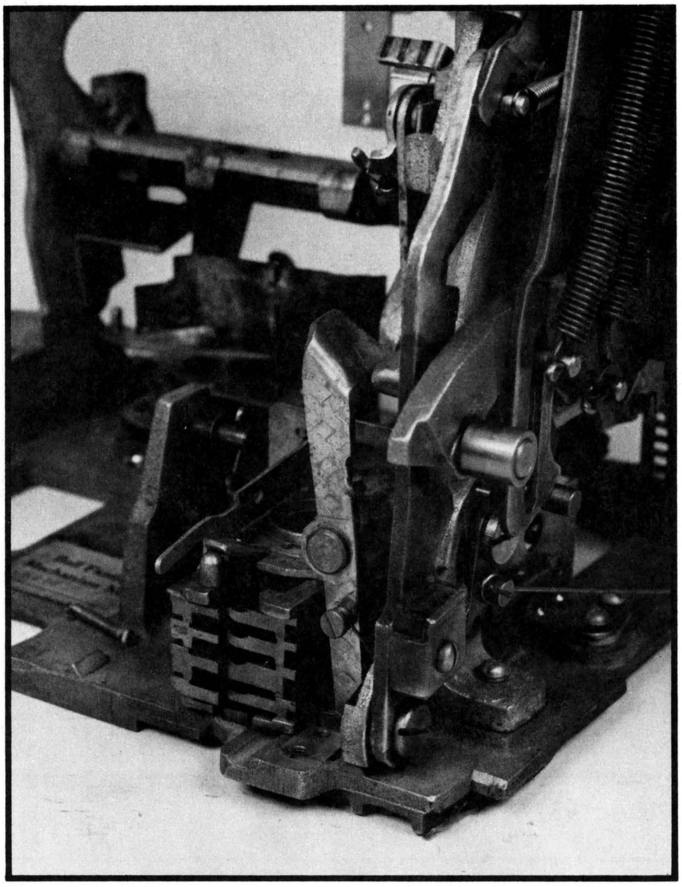


Figure 7.81

is due to the action of the vertical payout levers. In this example, after the slides have been released by the payout slide lock lever, the bottom two slides will be free to travel toward the rear of the mechanism while the third slide will be held in place by its corresonding horizontal payout lever. Since the bottom thickness of the lower two payout slides is equal to five coins, this situation represents a payoff of five coins.

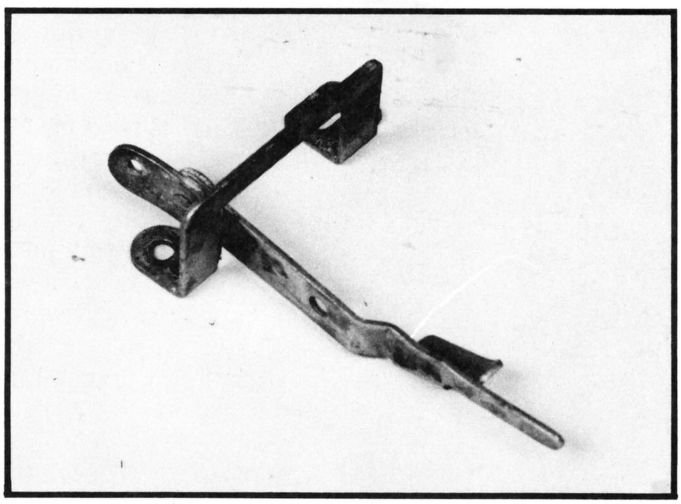


Figure 7.82

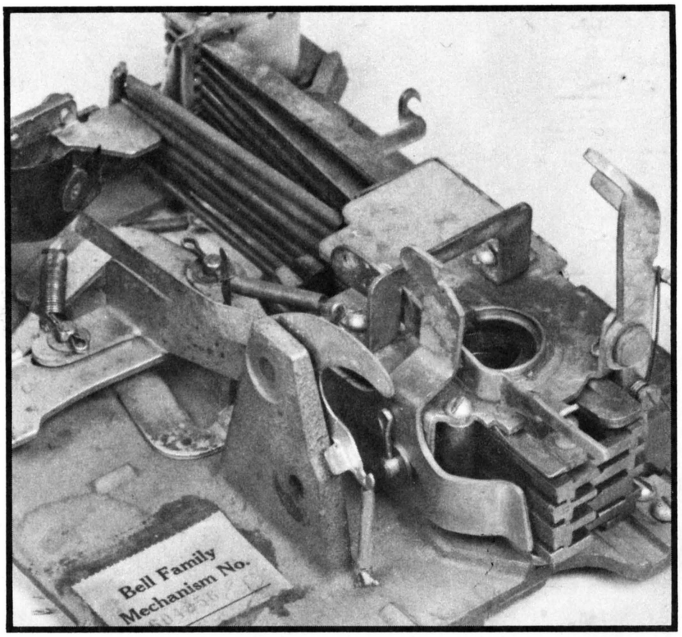


Figure 7.83

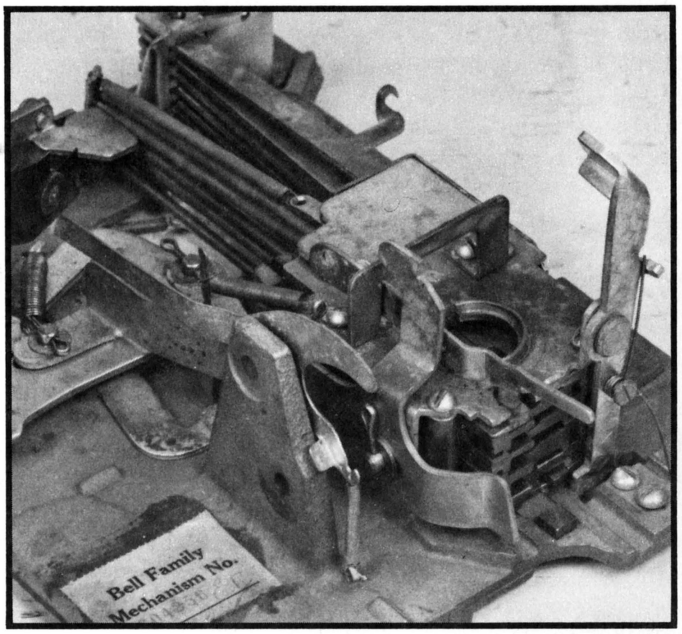


Figure 7.84

Slide Tampering Lock (Slide Stop Lever)

Figure 7.78 shows the payout slide coverplate assembly. This assembly also provides the mount for the jackpot pushbar, the jackpot trip lever, the bottom of the payout coin tube, and the payout slide stop lever. It is the function of the payout slide stop lever to inhibit motion of the payout slides, once they have been placed in a payout position from a previous play, until the main operating lever has been partially depressed in the succeeding cycle. By locking the slides in their released position, it is impossible to tamper with them from the outside (a cheating process called "spooning") until the mechanism is well into its wind-up cycle on the next play.

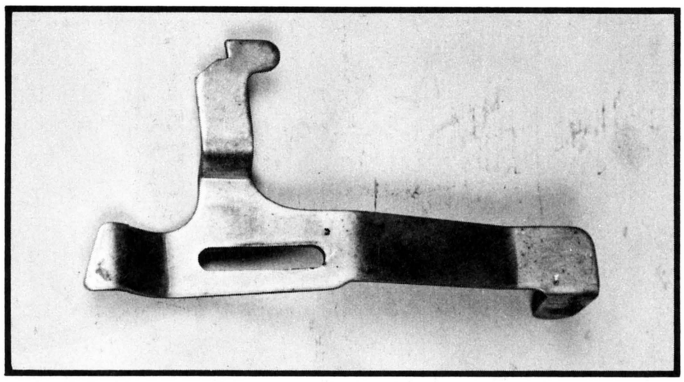


Figure 7.85

Figure 7.79 shows the coverplate assembled onto the mechanism. The slides are shown after a payout has occurred from the previous cycle. Figure 7.80 shows the mechanism during its wind-up cycle. It should be noted that while the payout slide pushbar is attempting to push the master slide forward, the payout slide stop lever is inhibiting travel of the payout slides. In Figure 7.81 the operating lever has finally reached a position where it is moving the payout slide stop lever away from the master slide, thus allowing forward travel of the master slide. It should be noted that with wear, this lever can create excessive friction against the payout slides and debilitate their proper operation; it is for this reason, that

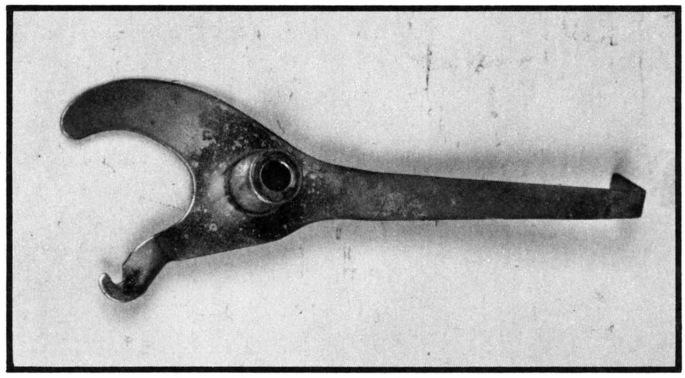


Figure 7.86

on many older machines, this lever has been completely removed from the payout slide coverplate.

Jackpot Tripping

Figure 7.82 shows the jackpot trip lever assembly. It is the function of this trip lever to translate the sliding of the jackpot slide into the operation of the jackpot. This is done by the stud, which is on the end of the jackpot slide, caming the trip lever upward, and this trips the jackpot mounted directly in front of it (see Appendix B for alternate jackpot tripping).

Figure 7.83 shows the jackpot trip lever mounted on top of the payout slide coverplate with the slides in their ready or cocked position. Figure 7.84 shows the relative position of the slides and the jackpot payout lever after a jackpot has occurred. Note how the jack-

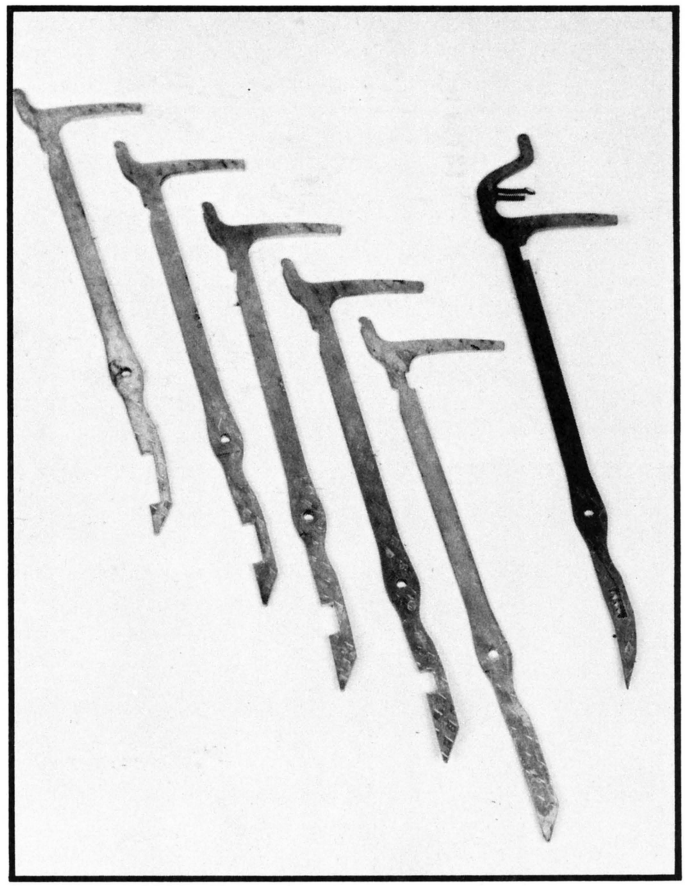


Figure 7.87

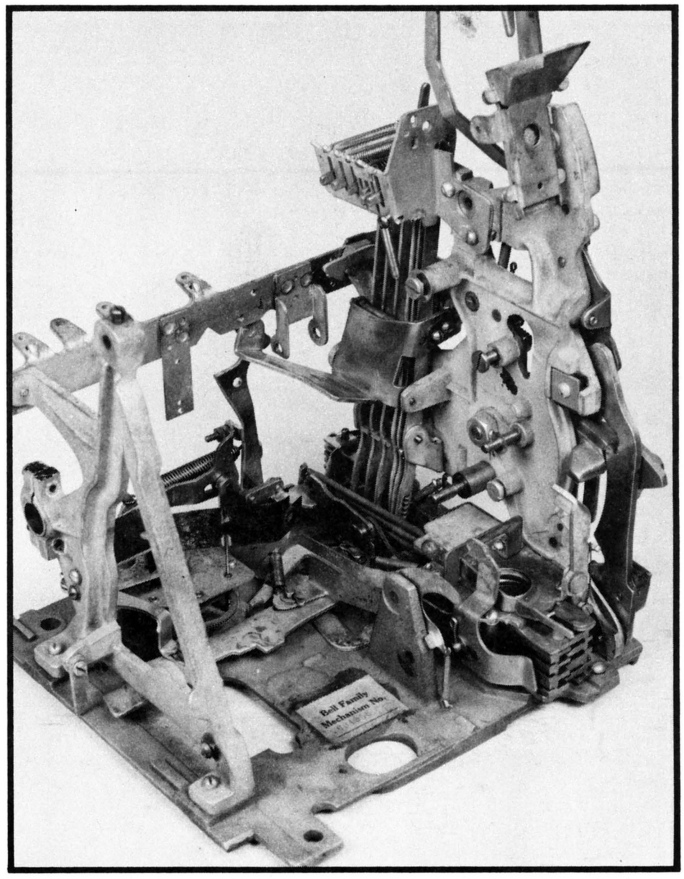


Figure 7.88

pot payout lever has been elevated into the air, away from the payout slides. It is this motion which eventually activates the jackpot itself.

Jackpot Resetting

Figure 7.85 shows the jackpot pushbar. It is the function of this pushbar to reset the jackpot and cycle the reserve jackpot each time the mechanism is cycled. This is accomplished by the forward motion of the bar against the jackpot.

Figure 7.84 shows the jackpot pushbar installed in the mechanism. It should be noted that it is coupled to the reel timing lever which supplies it with its forward motion each time the machine is cycled.

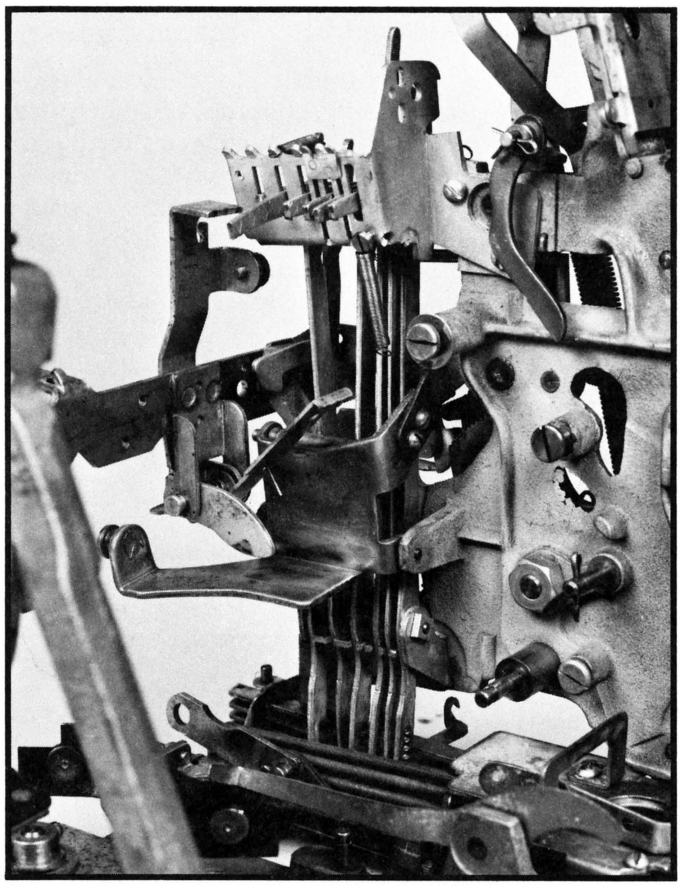


Figure 7.89

Clock Fan Control

Figure 7.86 shows the fan stop lever assembly. It is the function of this lever to inhibit the motion of the clock fan while the jackpot door is open. This prevents tampering with the jackpot door and receiving the reserve jackpot on subsequent plays.

Figure 7.84 shows the fan stop lever assembled in the mechanism. When the mechanism is installed in the case, the closed jackpot presses back on the fan stop lever, releasing it from the clock fan.

The Vertical Payout Levers

Figure 7.87 shows the vertical payout levers for this mechanism. In this mechanism there are a total of six,

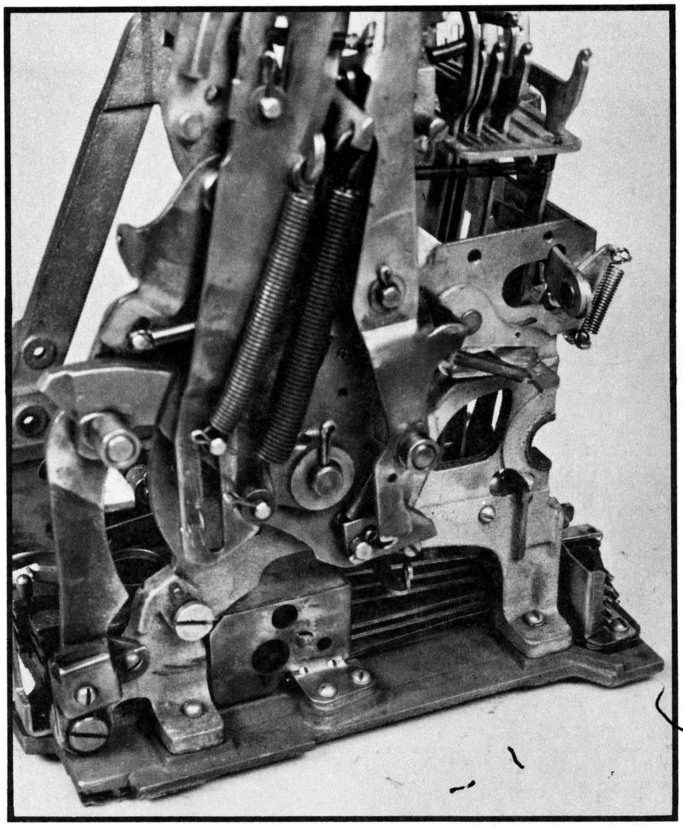


Figure 7.90

and each lever seeks a different fruit symbol — the cherry, orange, plum, bell, watermelon and the jackpot bar. In most standard machines there are no watermelons, in which case there are only five payout levers necessary.

At the bottom of each payout lever there is a different vertical thickness, and it is this thickness which will be moved and thus determine the payout. Consequently, each of the vertical payout levers is given a number of coins associated with it such as the fourteen coin vertical payout lever or the ten coin vertical payout lever, etc. Figure 7.88 shows all six levers installed in the mechanism. The cocking and releasing of these levers has been previously described in this chapter.

Figure 7.89 shows the situation where the ten coin vertical payout lever has penetrated the three reel discs simulating a ten coin payoff. By looking at the interaction of this lever with the horizontal payout levers, it will be noticed that the bottom three horizontal payout levers have been pushed to the side thus releasing the bottom three payout slides. Figure 7.90 shows this same situation as viewed from the right-hand side of the mechanism. This basic interaction of the vertical payout levers with the horizontal payout levers determines which slides will be released and thus the payoff.

Two of the vertical payout levers deserve special mention. First, the payout lever used to sense cherries has a particularly different form, since its penetration is either through one disc or two discs and unlike the

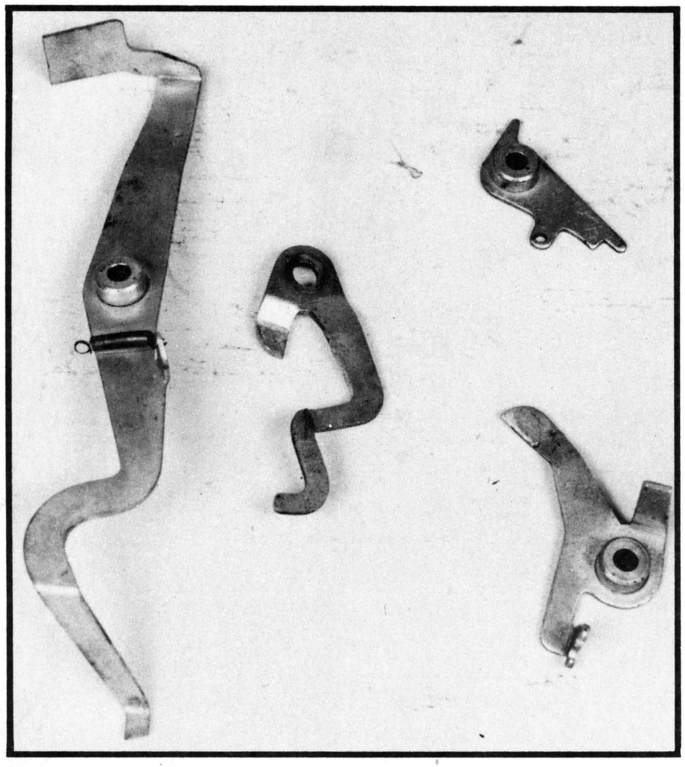


Figure 7.91

others it does not need to continue all the way through. This lever senses a differential amount of movement; the greater the movement the greater the payout. At the bottom of the cherry lever there is a step effect on its shoulder such that when the lever has moved through one disc (corresponding to one cherry) the bottom horizontal payout lever is moved; if the penetration increases through the second disc (correponding to two cherries), the lever then picks up the next horizontal payout lever for the additional payoff of three coins. Some very late machines offered a ten coin pay for three cherries; payoff was usually accomplished by the same lever in a like manner.

Secondly, the twenty coin jackpot lever activates all of the horizontal payout levers, thus releasing all the payout slides, including the top one which contains the stud for activating the jackpot trip lever. Because of the threat of tampering with the mechanism, this payout lever is especially guarded by the addition of the extra spring to prevent jackpot dumping due to external causes.

Coin Tube Management After Jackpot Release

Figure 7.91 shows the four levers which are associated with the control of the coin tube payout after a jackpot has been released. The name and function of each of these levers will be discussed starting from the left. The first lever shown is called the coin tube shutoff lever. The function of this lever is to divert coins from the escalator which would normally go into the coin tube directly to the overflow tube and consequently into the jackpot.

It is the position of the shutoff lever which controls and manages the coin tube. After a jackpot has occurred, the coin tube is sensed to see if it is over half filled with coins. If it is over half filled, the coin tube shutoff lever is activated and diverts the successive coins played into the overflow tube and consequently to the jackpot. Each time the machine is cycled thereafter, the payout tube is again checked to see that

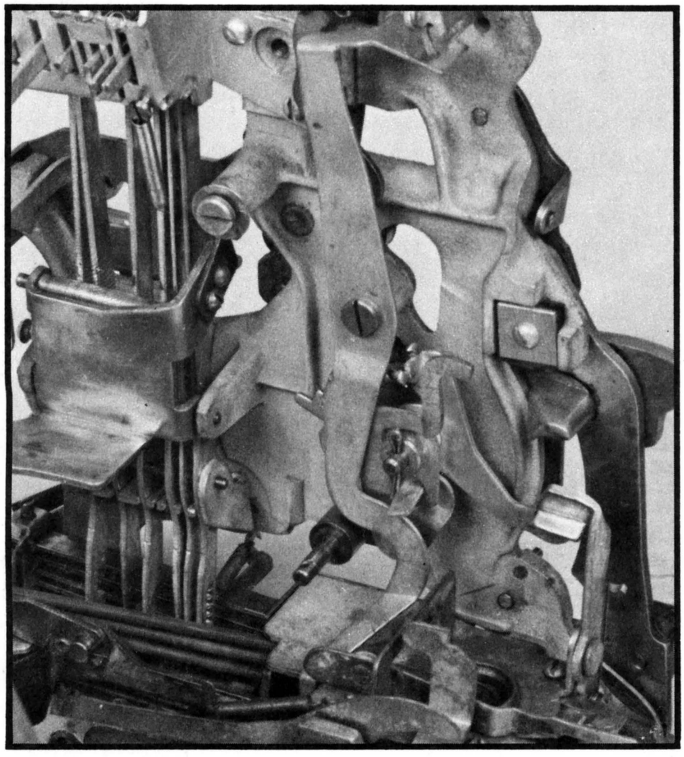


Figure 7.92

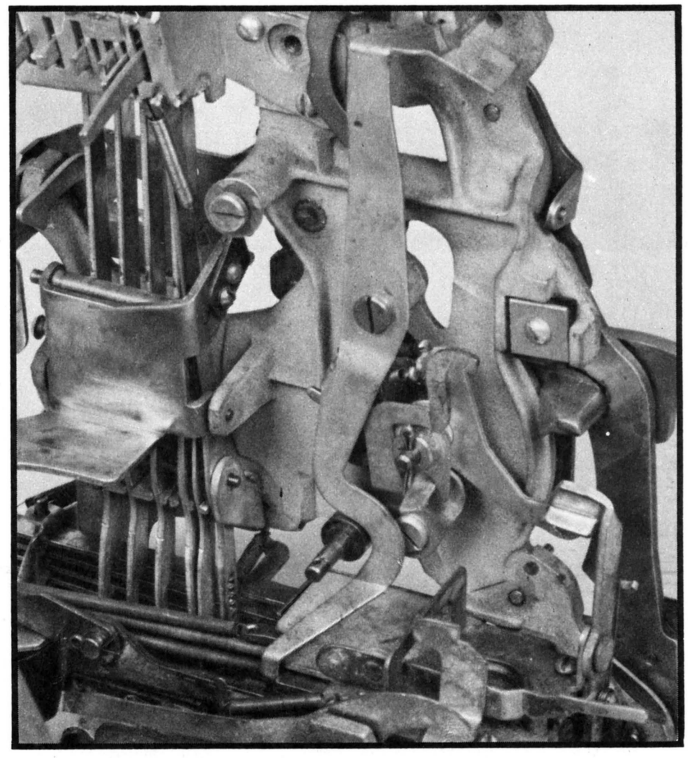


Figure 7.93

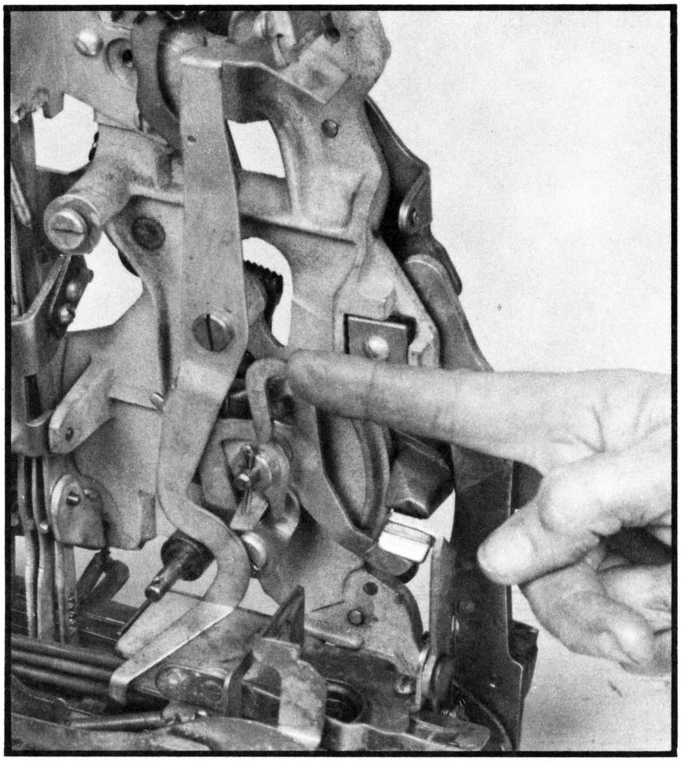


Figure 7.94

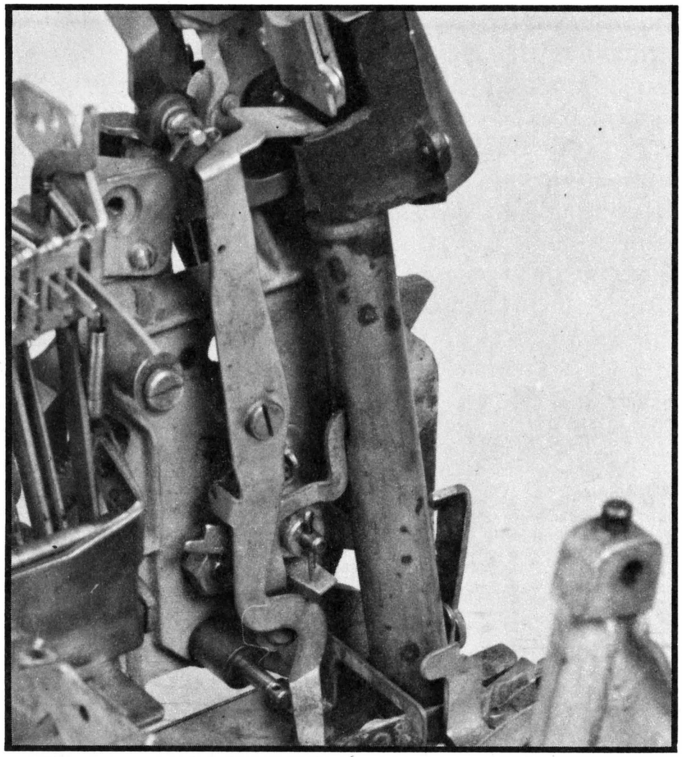


Figure 7.95

the level of coins in the tube is at least half way up. If, at any time during the cycling of the mechanism, the level of coins goes below the halfway mark, the coin tube shutoff lever is automatically retracted, allowing succeeding coins to enter the coin tube. The shutoff lever will then remain in that position until another jackpot is achieved.

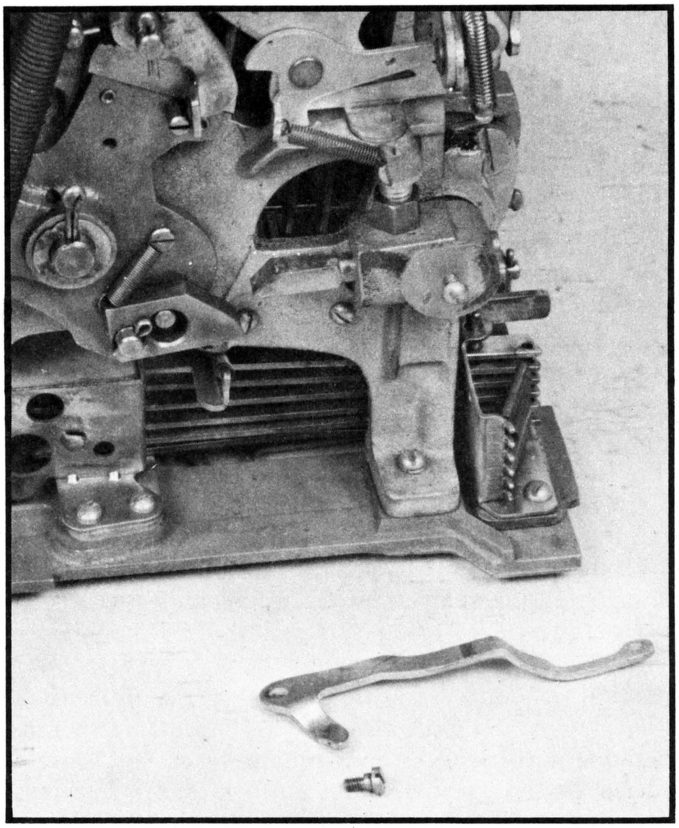


Figure 7.96

This somewhat sophisticated method of coin tube management was primarily used in locations where there was no ability to monitor or fill the jackpots after they had been hit. Since one of the great "come-ons" of the machine is to always have the jackpot filled, and although the reserve jackpot helps to fill the jackpot, it is an extra "shot in the arm" to get

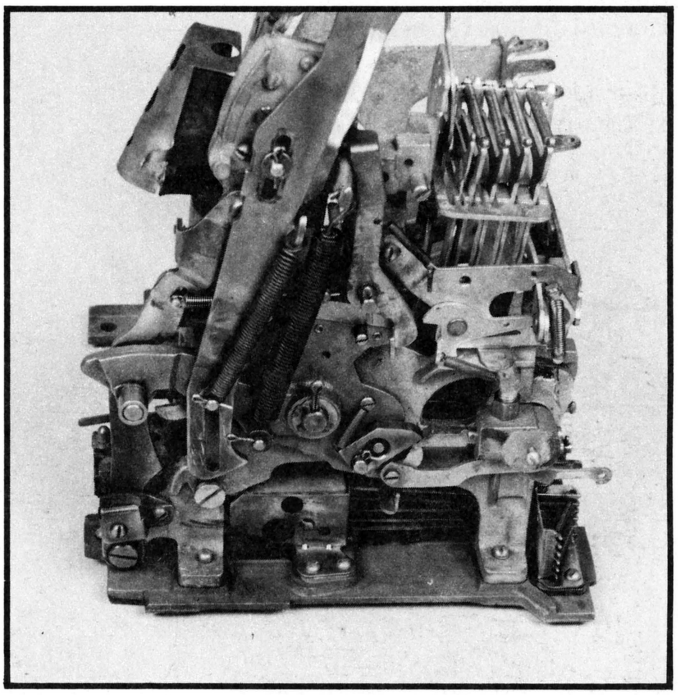


Figure 7.97

coins to the jackpot area as fast as possible, so long as the coin tube can "afford" it.

The next lever shown in Figure 7.91 is the coin tube shutoff detection lever assembly and it is responsible for monitoring the height of the coins in the tube. The remaining two levers are the shutoff latch and the shutoff activator lever, which provide the motion to the coin tube shutoff lever and the coin tube shutoff detection lever.

Figure 7.92 shows these four levers installed in the mechanism in their proper places. Positions of the levers shown in this figure correspond to the ready position or steady state with the jackpot filled and the shutoff lever retracted allowing normal operation. Figure 7.93 shows the position of the shutoff lever immediately following the occurrence of a jackpot. This shutoff lever has been moved forward by the motion of the jackpot slide toward the rear of the mechanism. During the next cycling of the mechanism the coin tube shutoff detection lever, indicated by the finger in Figure 7.94, attempts to enter the coin tube to determine if the coins are at that height. If the coins are at that height, the motion of the detection lever is inhibited, and the shutoff lever remains in its forward position. If, however, the detection lever travels to its full forward position, indicating that the coins in the payout tube are below this level, the shutoff lever is released and is pulled back to its normal position. Figure 7.95 shows all of these levers and their relative position with respect to the coin tube when installed. Because of the relative intricacy of these parts, it is quite easy for the oil to become gummy and cause a malfunction of this system. A malfunction in this system usually results in the shutoff lever staying in the shutoff position, and eventually the coin tube runs out of coins, causing no payouts when they occur on the payout line. Thus, if this system is incorporated in the mechanism, it is essential that it be kept clean and in perfect working condition. For home use this entire system is considered non-essential.

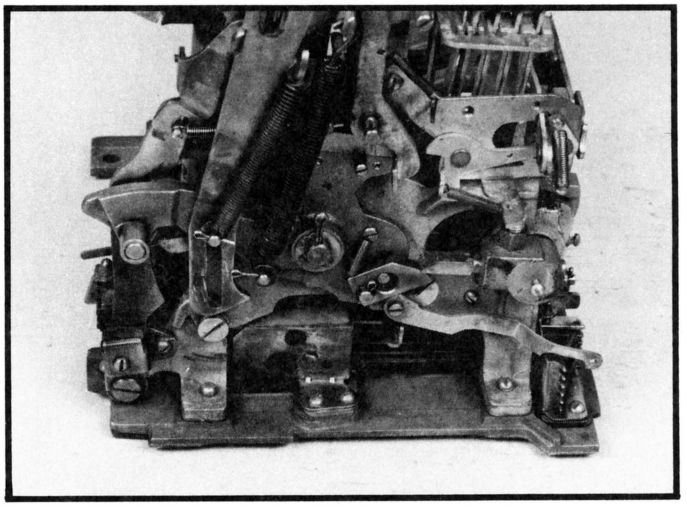


Figure 7.98

Machine Cycle Bypass Lever

Figure 7.96 shows the coin tube loading arm and its shoulder screw. It is the function of this lever to bypass the mechanism cycling when rotating the main operating lever. The reason for this bypass is to cycle only the escalator and thereby load coins into the coin tube via the escalator without having to have the mechanism go through its complete cycling process. Since it is relatively simple and far more expedient to remove the mechanism and load directly into the coin tube, this lever is more of an operational frill rather than a practical method for home operation. Figure 7.97 shows this lever installed on the mechanism in its upward or bypass position. Note that the dog on the main operating lever has bypassed the extension arm on the main operating fork and thus does not cycle. Figure 7.98 shows the bypass lever in its normal position, allowing the dog on the main operating arm to engage the arm on the operating fork. For home use this lever is considered non-essential, but it does have some utility in checking out the mechanism/escalator interface.

8 Assembly of the Operating Mechanism

Introduction

This chapter assumes that the reader has disassembled the mechanism as outlined in the previous chapters and has read the chapter on lubrication, some portion or portions of the preceding chapter on the theory of operation and that some of the nomenclature of the mechanism is familiar. Much of this chapter is basically the chapter on disassembly written in reverse. Comments have been added, however, on how to inspect for wear and tear, the necessity of incorporating the particular assembly, potential adjustments that may be required in order to prevent malfunctioning and insure proper operation and techniques used in assembling the various parts. This chapter begins with the bare machine as shown in Figure 8.1 and ends with the mechanism ready to have the clock and slides installed. The final installation of the clock, slides and reel assembly is covered in Chapter 5, after the cleaning of the mechanism had been accomplished.

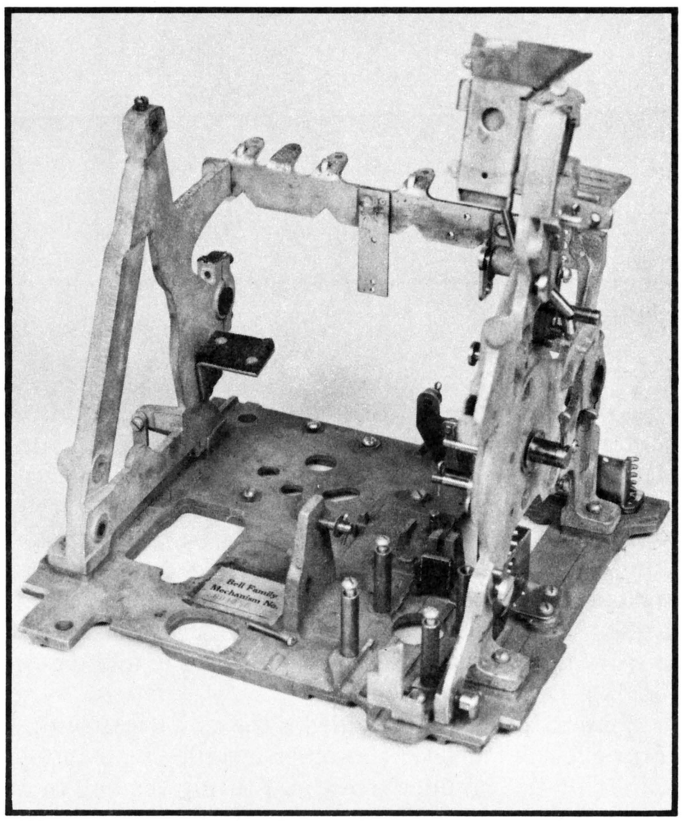


Figure 8.1

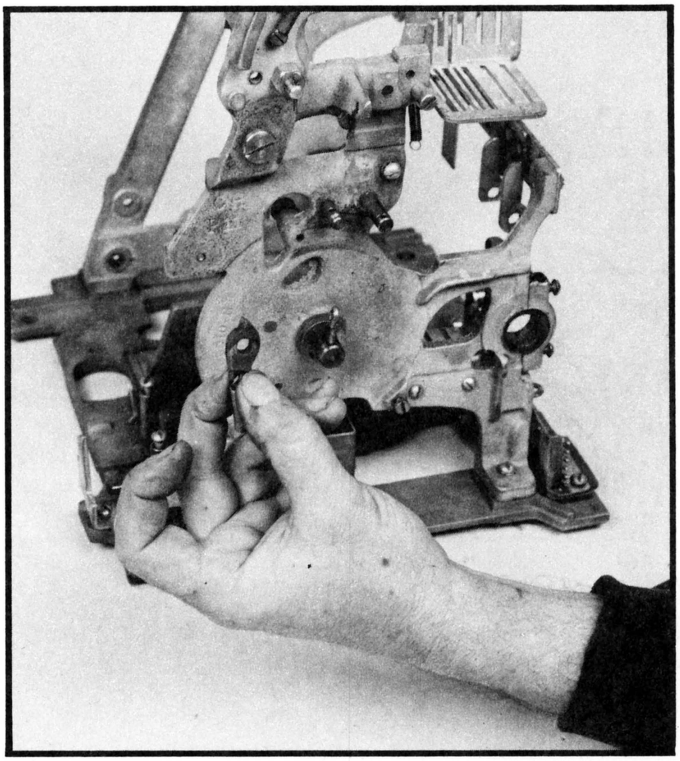


Figure 8.2

It is assumed that since the mechanism has been completely disassembled, all of the major components and assemblies have been thoroughly cleaned and all of the working parts have been cleaned and lightly oiled with fresh lubricant. This assumption will eliminate many of the repetitive comments concerning oiling and greasing as the mechanism is rebuilt.

Assembling the Right Side of the Mechanism

The assembly of the right side of the mechanism begins by installing the main operating lever dog on its corresponding stud, attaching it to its extension spring and securing it with a cotter pin as shown in

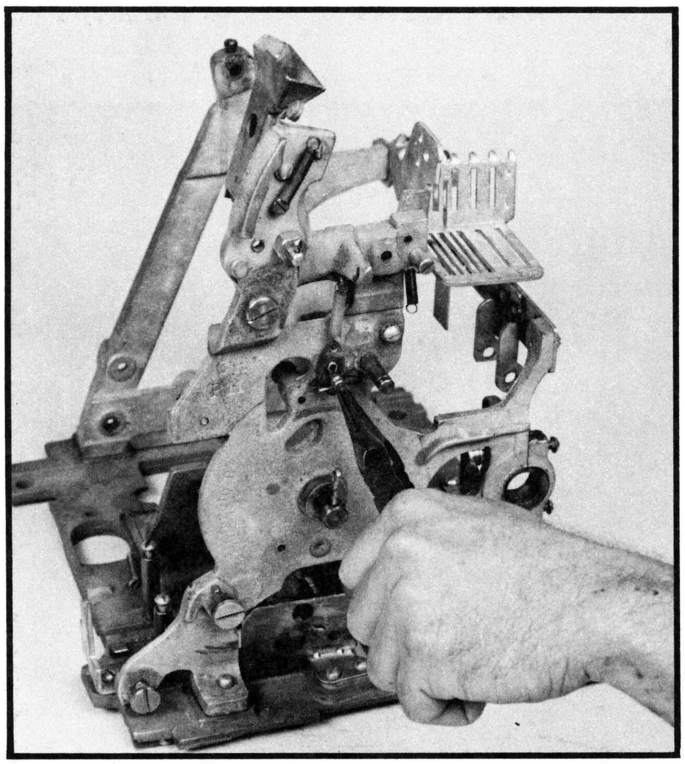


Figure 8.3

Figures 8.2 and 8.3. It should be under light tension from the spring and must rotate freely in either direction.

The next part to be installed is the operating lever lock assembly. The lever is mounted to the mechanism by firmly tightening its shoulder screw as shown in Figures 8.4 and 8.5. The rubber should be replaced on the bottom portion of this lever if it is worn, since it is this rubber which acts as the shock absorber for the bottom end of the throw of the main operating lever. The rubber is easily replaced by simply removing the screw on the metal plate which holds the rubber to the lever. Once installed, this lever should rotate freely in either direction.

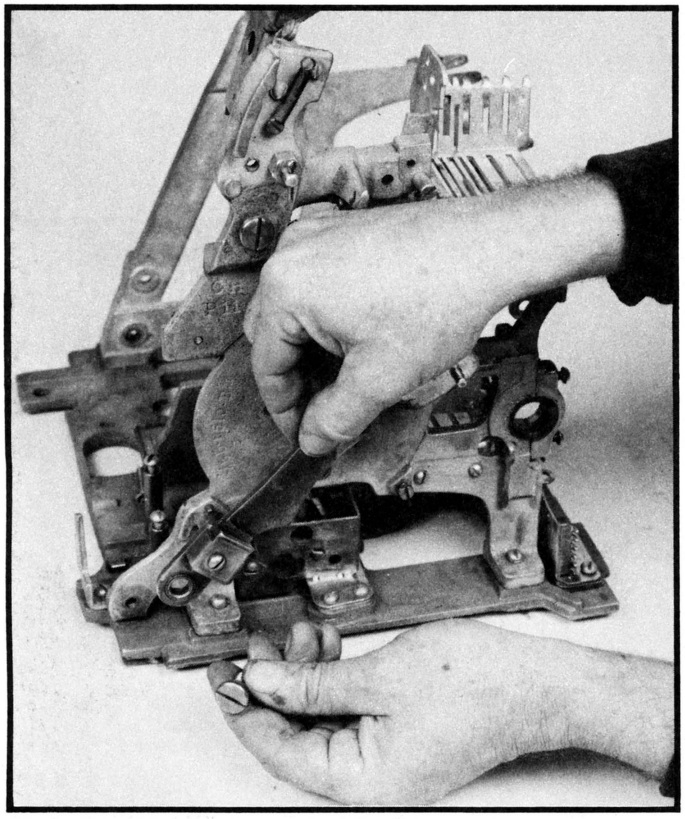


Figure 8.4

The main operating lever is next to be installed. It is mounted on the shoulder stud and secured with a washer and cotter pin as shown in Figures 8.6 and 8.7. When installed, the operation of the lever should be checked by rotating it in a counter-clockwise direction and checking that the dog catches the ratchet (on top of the main operating lever) to prevent it from being rotated in a clockwise direction until it completes its full counter-clockwise rotation. When it reaches the end of its rotation, it should then be able to be freely rotated clockwise to its beginning position. Also check when the operating lever stop is pressed against the operating lever, that the rotation of the operating lever stops and can be reversed back to its normal position without causing any locking of the dog.

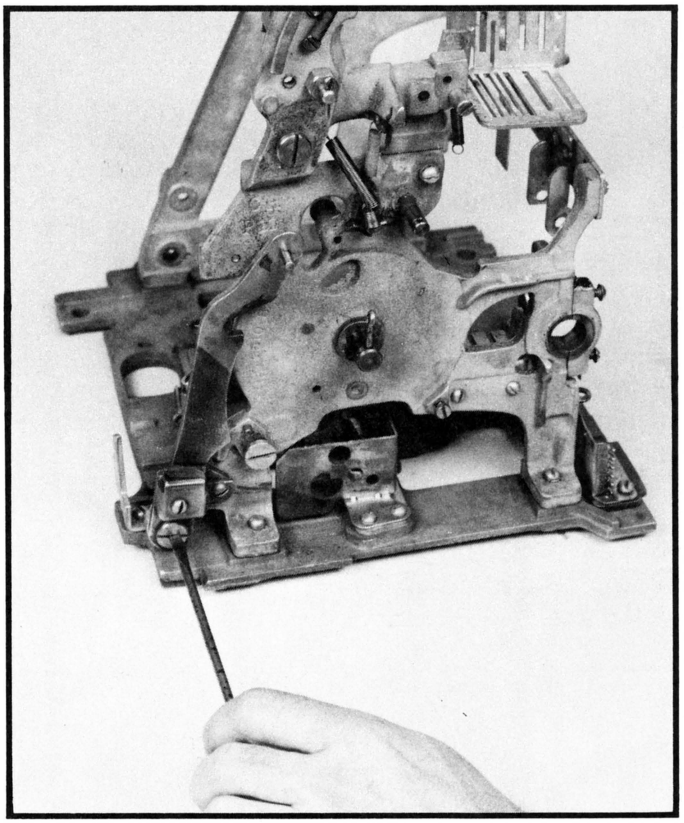


Figure 8.5

The next part to be installed is the coin detector operating lever. The lever should be installed by securely tightening its shoulder screw and fitting the end of it to the post at the end of the operating lever stop assembly as shown in Figure 8.8. The extension spring

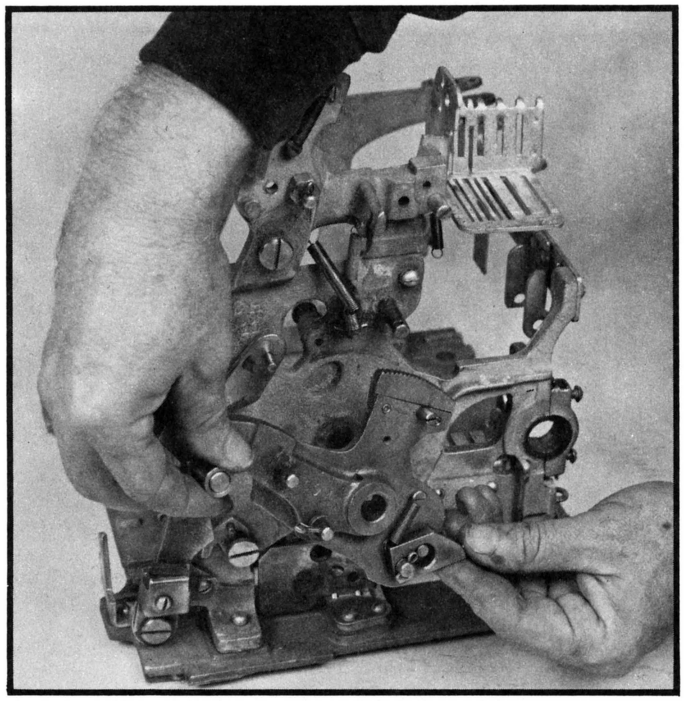


Figure 8.6

is connected to the post at the end of the operating stop assembly as shown in Figure 8.9. After this spring has been attached, the function of the coin detector lever should be checked by attempting to depress the main operating lever and noticing the action of the coin detector lever. By holding back on the coin detector lever, the main operating lever should be allowed to complete its full downward cycle. The motion of these assemblies should be smooth and without friction except for the interaction of the dog on the ratchet of the main operating lever.

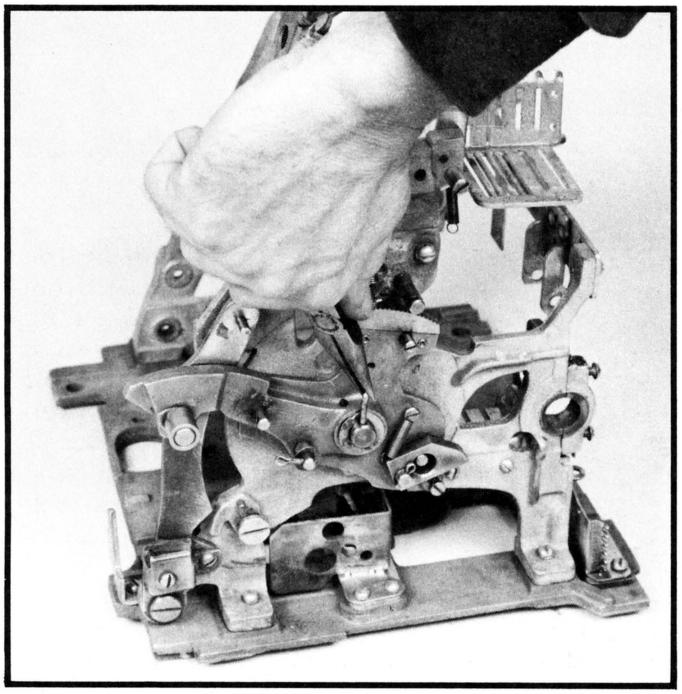


Figure 8.7

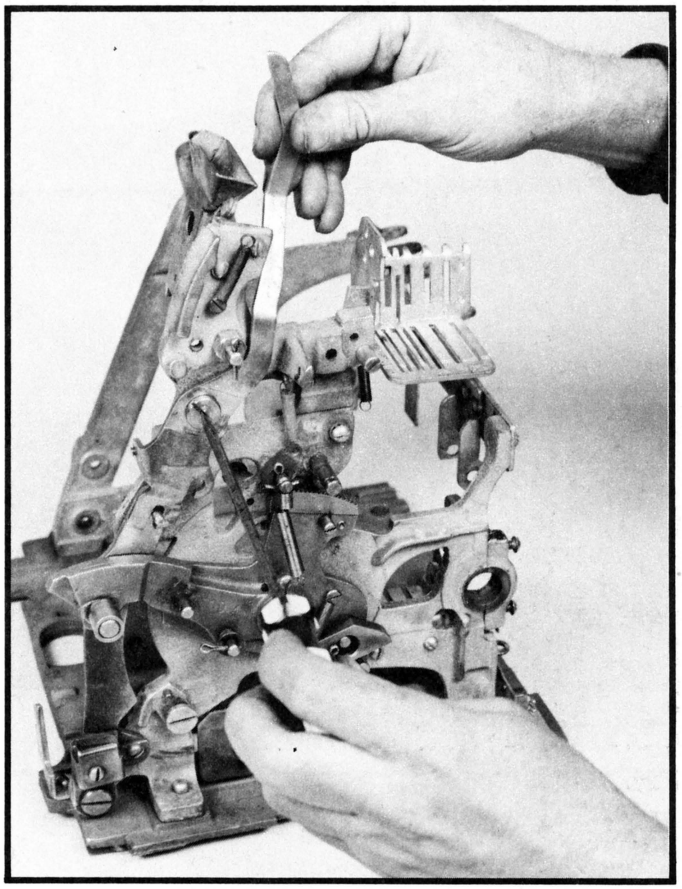


Figure 8.8

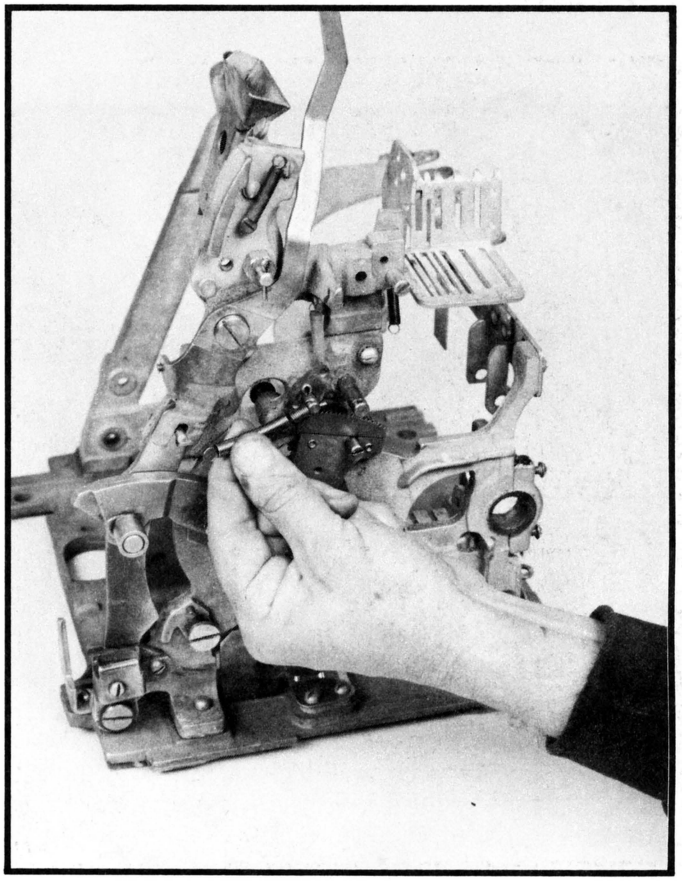


Figure 8.9

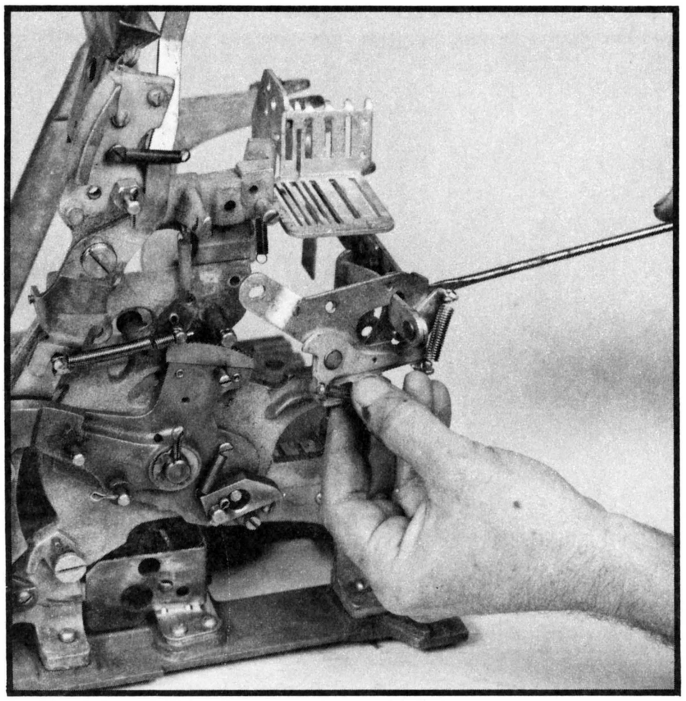


Figure 8.10

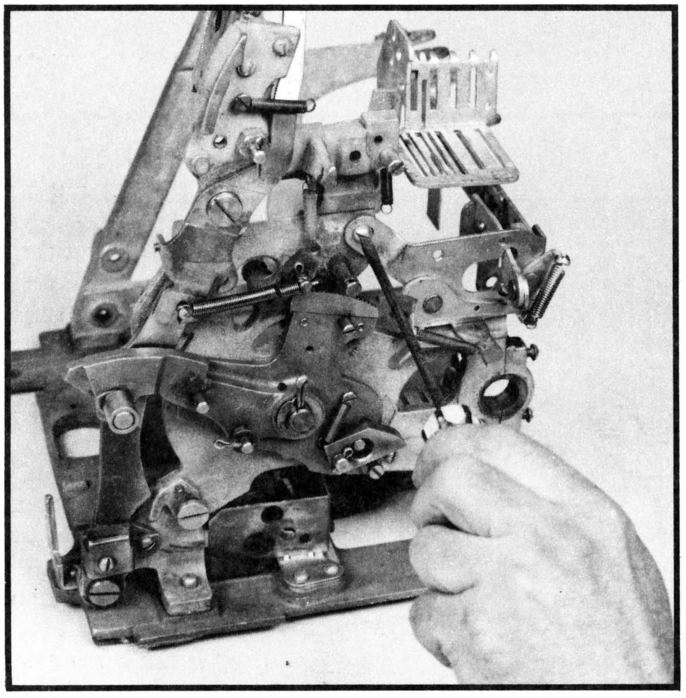


Figure 8.11

The next part to be installed on the frame is the anti-check payout base assembly. This assembly is mounted by two screws shown in Figures 8.10 and 8.11. Before installing this assembly make certain that all the levers on the base are free to operate and all gums and oils that could inhibit such freedom of motion have been removed and have been replaced with clean oil. This assembly is concerned only with check operation of the mechanism and it is not a necessary component, particularly for home use. If, however, it is desired to retain this part on the mechanism (if it

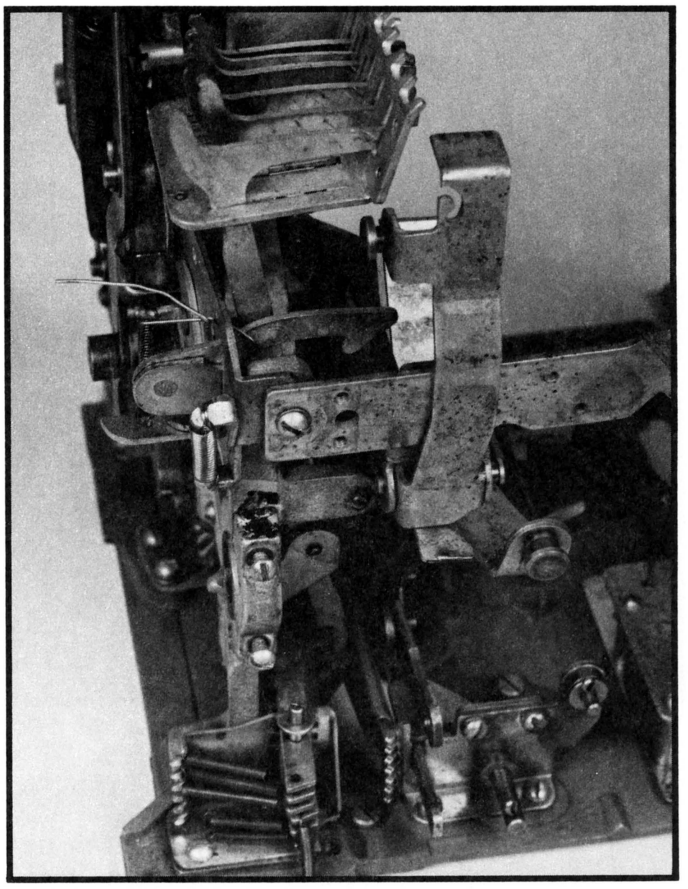


Figure 8.12

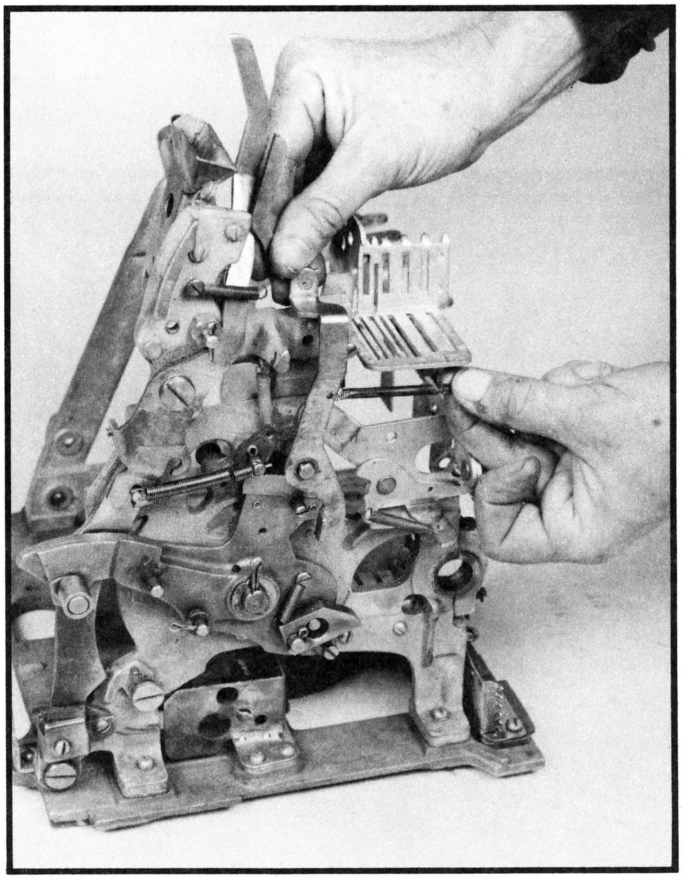


Figure 8.13

existed to begin with) then many collectors choose to have the hook which extends from this assembly wired in a permanent up position to prevent accidental locking and therefore causing a malfunctioning of the mechanism. A piece of wire wrapped around the hook and the hole in the base mechanism is adequate for this purpose as shown in Figure 8.12.

Next the coin overflow pushlever assembly is installed on the mechanism by placing it on the stud as shown in Figure 8.13. No cotter pin is put in the stud yet, since another lever also mounts on this stud. The

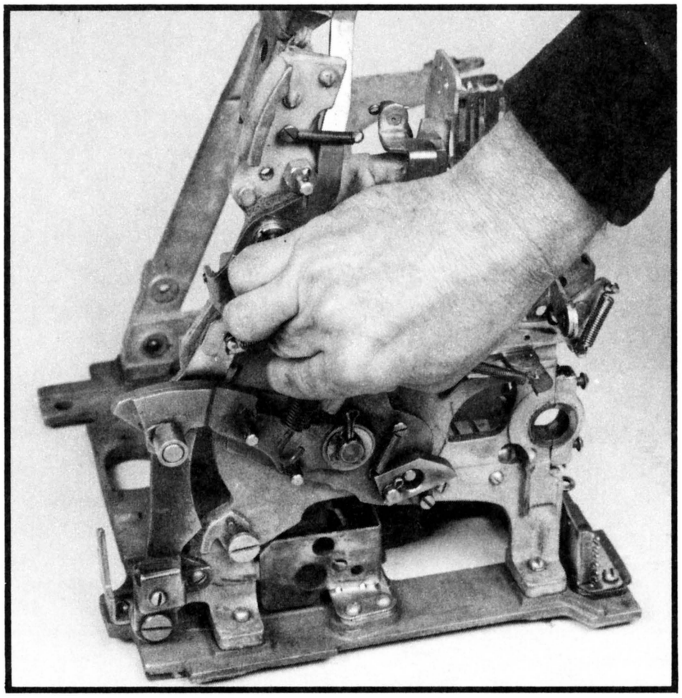


Figure 8.14

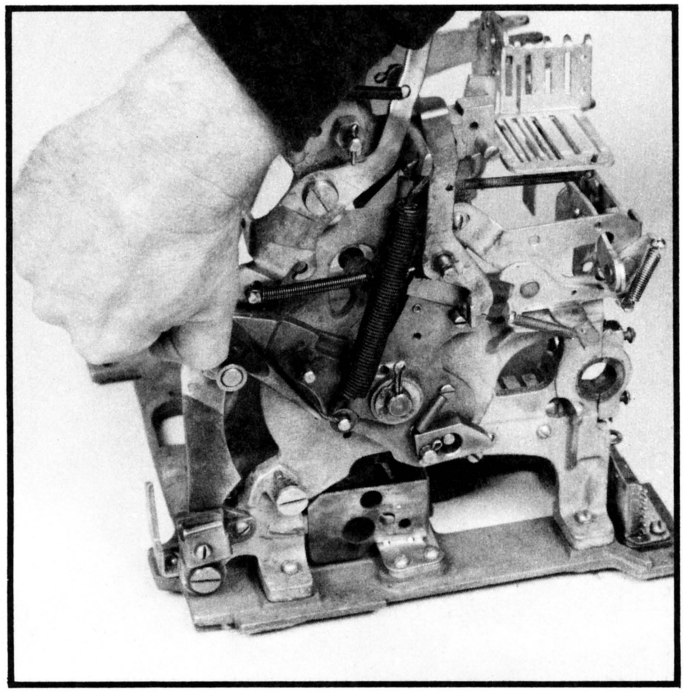


Figure 8.15

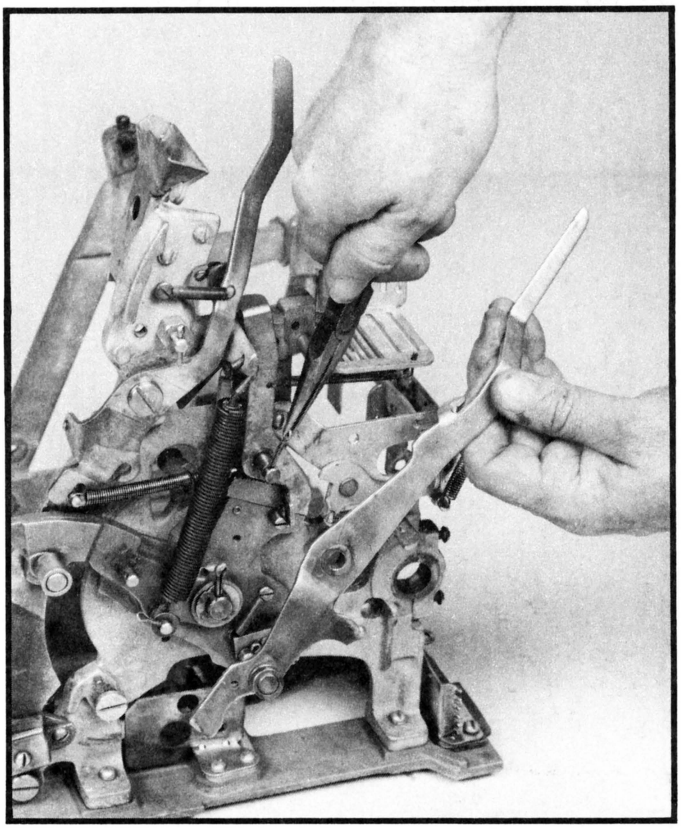


Figure 8.16

extension spring leading from the anti-check base assembly is connected to this lever as shown in Figure 8.13. The operation of this lever can be checked by cycling the main operating lever and noticing that this lever travels backwards during the wind-up cycle and remains there until the end of the return cycle of the main operating lever. The small crescent shaped lever on this assembly is called the coin rake and should be hanging freely on the other side of the frame from this lever.

Next, the main operating lever extension spring and hook assembly is installed on the frame as shown in Figures 8.14 and 8.15. The spring is installed by first placing the hook at the top end of the spring on the frame and then manually stretching the spring, so that it can be slipped over the mounting post on the operating lever arm. Once on the post, a washer and cotter pin is added to secure it in place. It should be noted that the upper end of this spring is adjustable and thus its tension can either be increased or decreased. The adjustment of this spring will be dealt with later since it is necessary to have the mechanism in the case to make the adjustment.

The check detector lever assembly is installed on the frame as shown in Figures 8.16 and 8.17. This lever is installed on the same stud as the coin overflow pushlever was installed, and after installation it is secured with a washer and a cotter pin. Next the extension spring leading from the top of the coin chute assembly is secured to the pushlever. While the check detector lever is not necessary for proper operation of

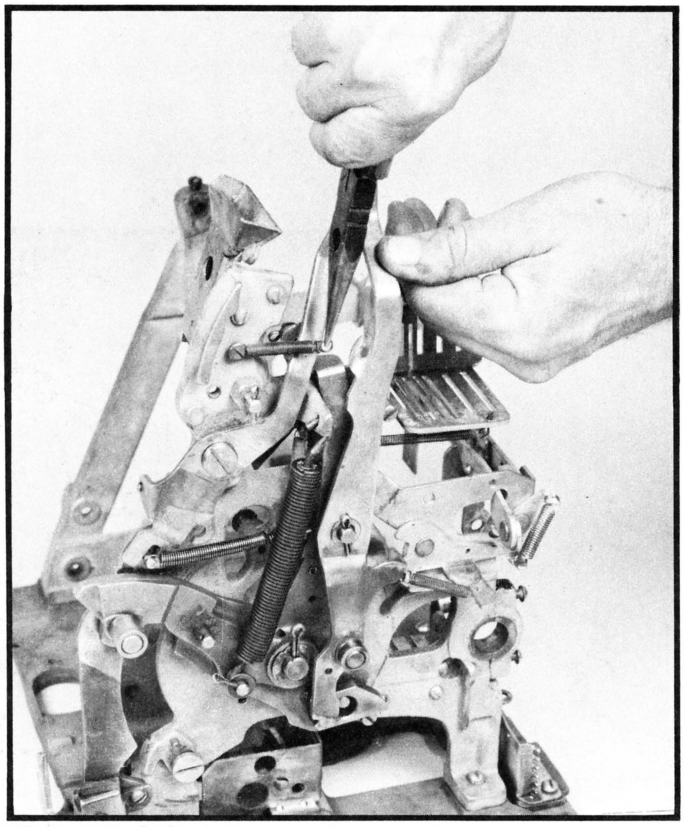


Figure 8.17

the mechanism, if it is not installed in the mechanism then a spacer bushing needs to be used in its place on its mounting stud in order to keep the proper positioning of the coin overflow pushlever assembly.

The coin advance bar operating lever is installed onto the mechanism as shown in Figures 8.18, 8.19 and 8.20. The lever is first installed on its two posts as shown in Figure 8.18 and the top post made secure by a washer and cotter pin. The extension spring is then added by first securing its upper end to the frame and then its lower end to the other post as shown in Figures 8.19 and 8.20. After the spring has been attached to the lower stud, a washer and cotter pin is added to secure both the lever and the spring to the stud.

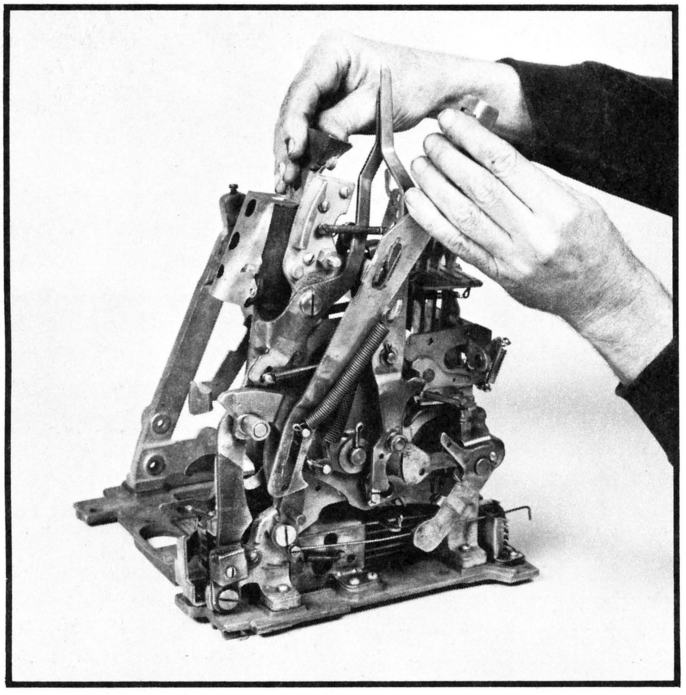


Figure 8.18

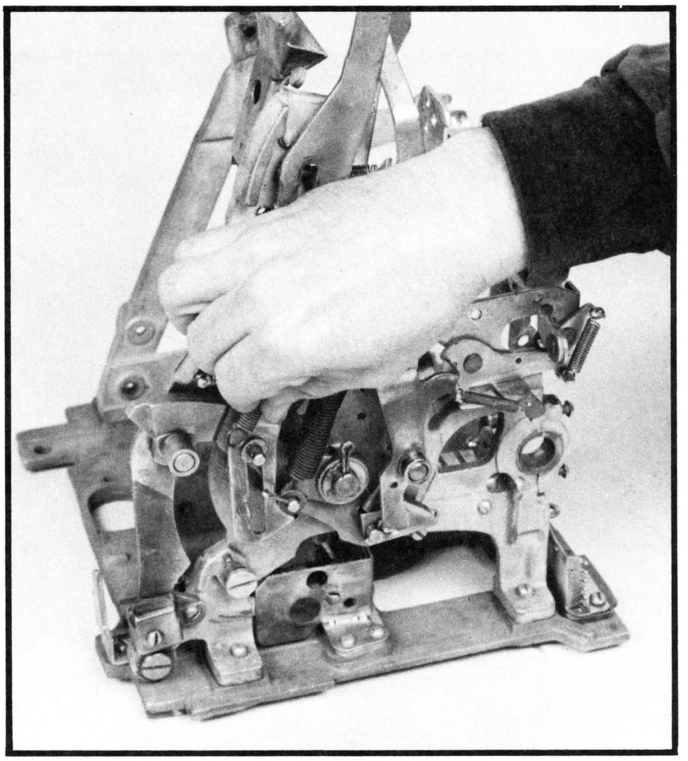


Figure 8.19

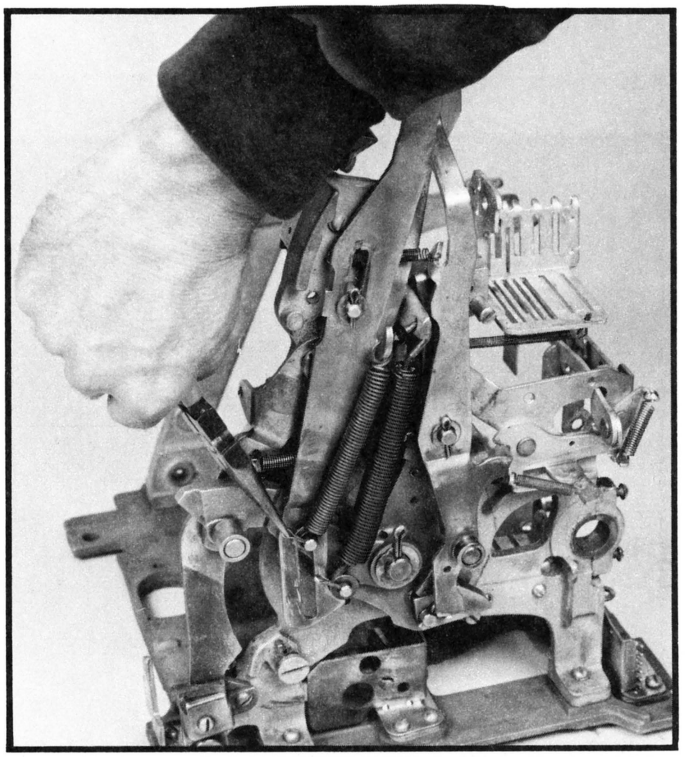


Figure 8.20

Next, the coin tube leading arm (machine cycle by-pass lever), is fastened to the mechanism by its shoulder screw as shown in Figures 8.21 and 8.22. This part is not essential for proper operation of the mechanism and is rarely, if ever, used.

Next the operating lever stop and pin assembly is

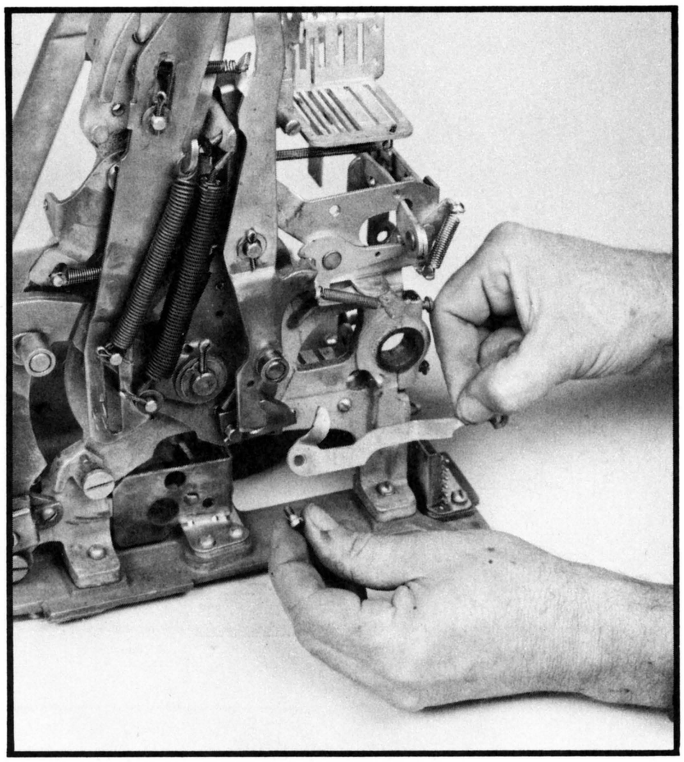
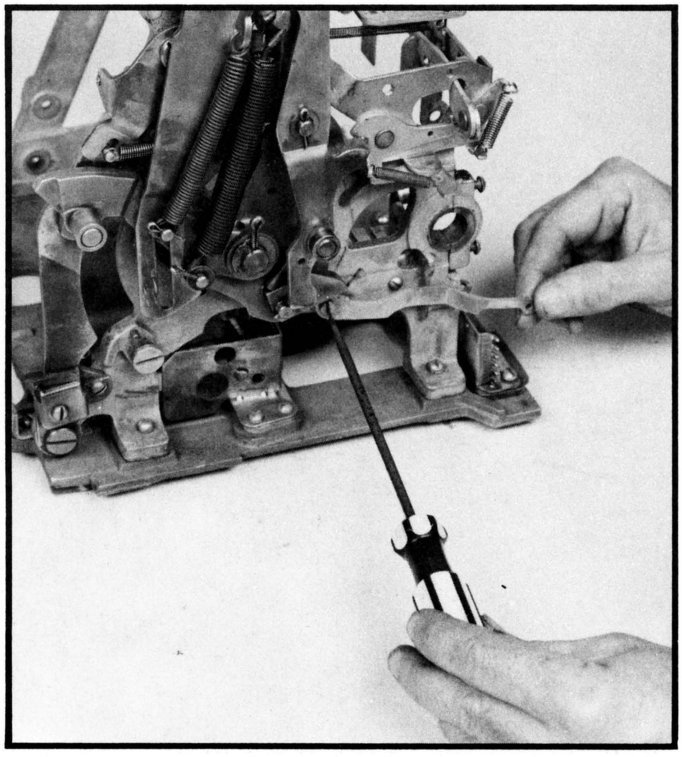


Figure 8.21



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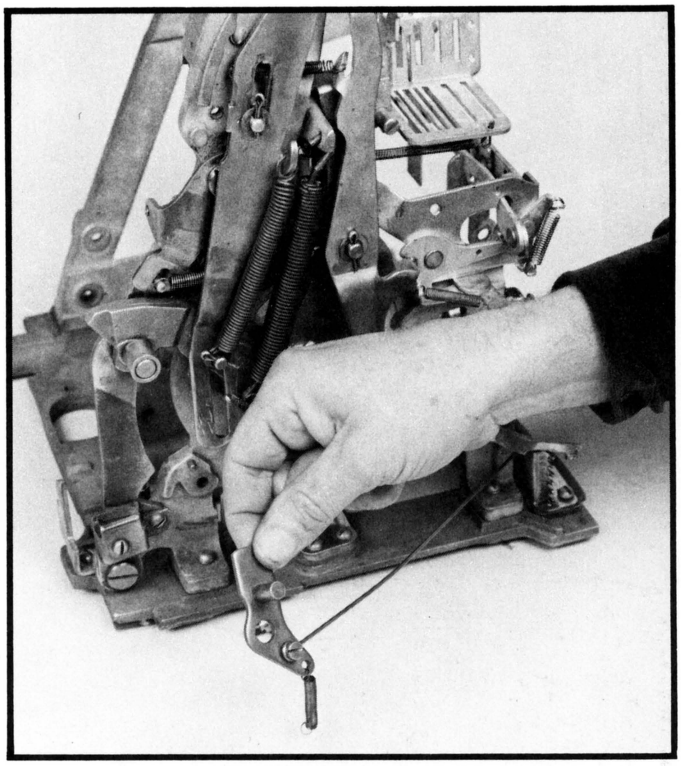


Figure 8.23

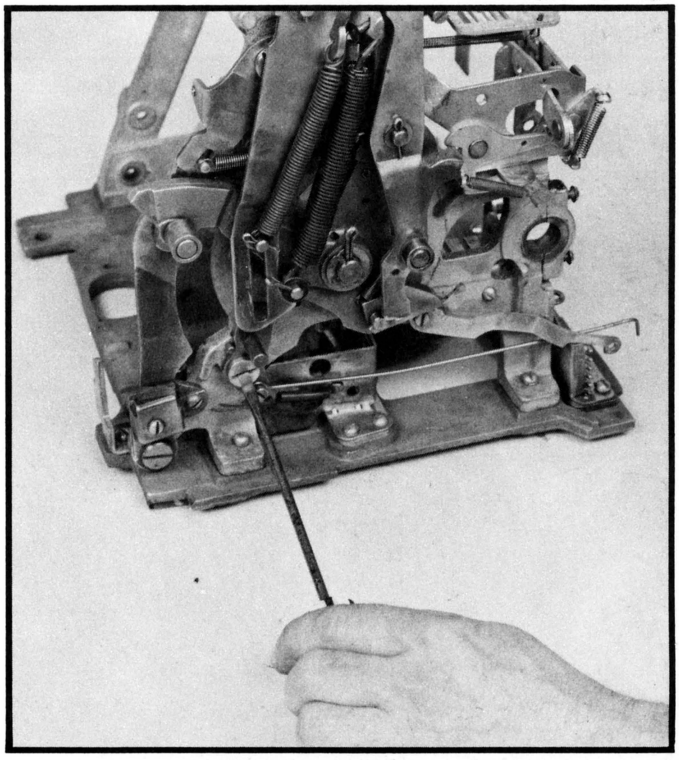


Figure 8.24

installed on the mechanism by its shoulder screw as shown in Figure 8.23 and 8.24. It should be noted that the wire handle leading from this lever must be fed through its appropriate hole on the back mounting bracket of the mechanism. While this part is not essential for proper operation of the mechanism, it *is* desirable to prevent possible damage to the escalator.

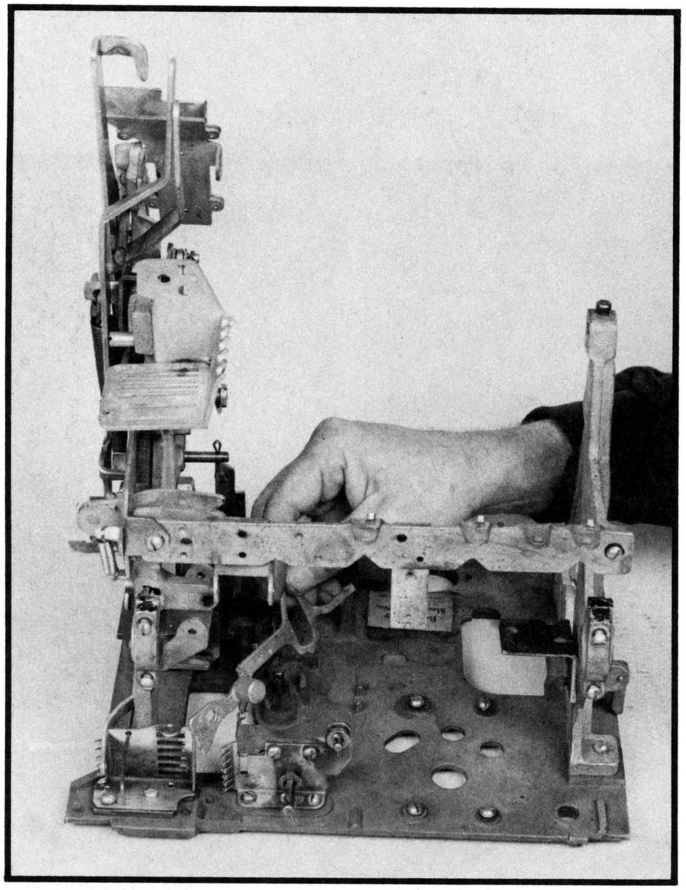


Figure 8.25

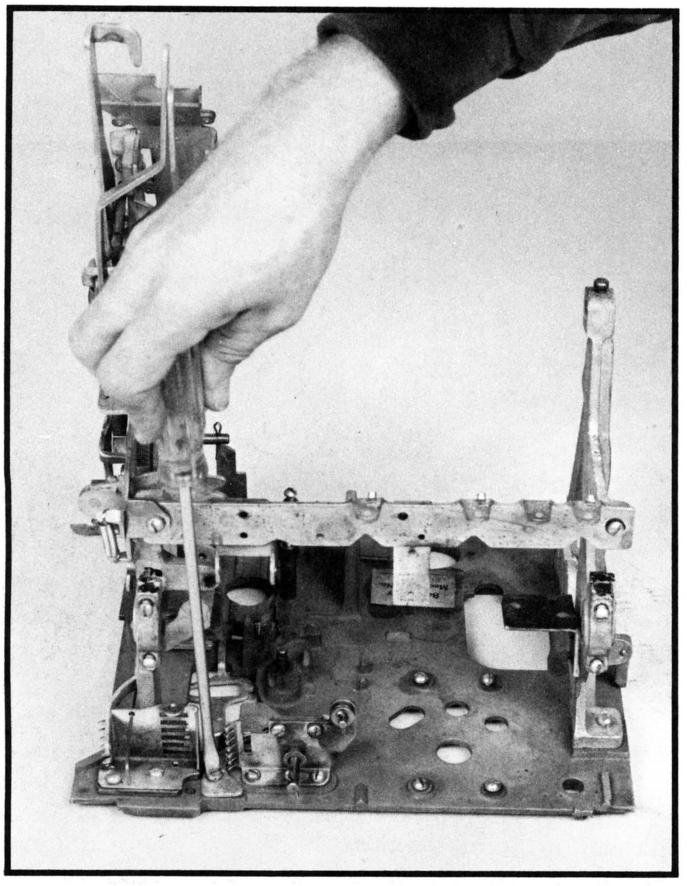


Figure 8.26

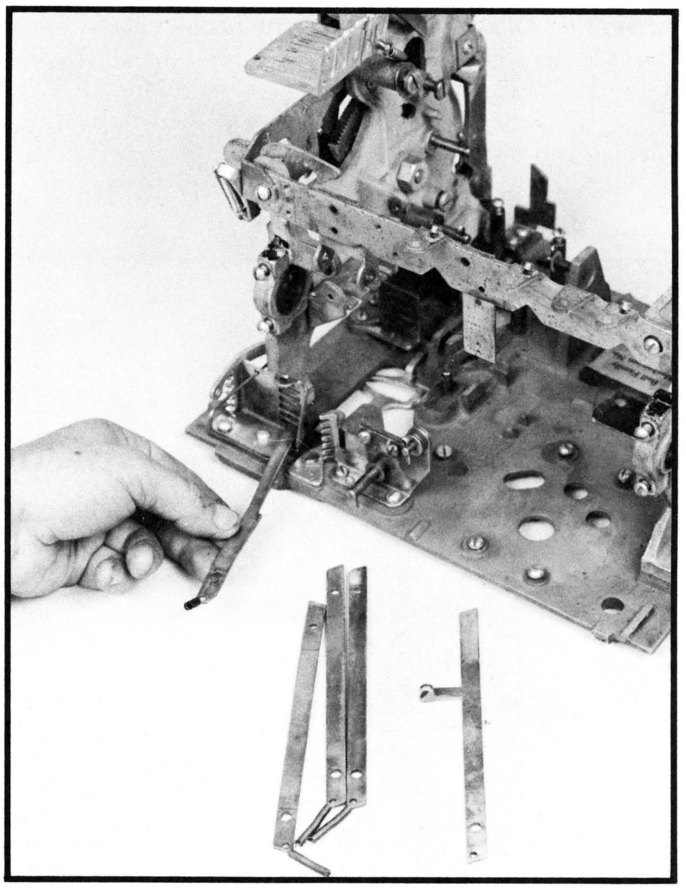


Figure 8.27

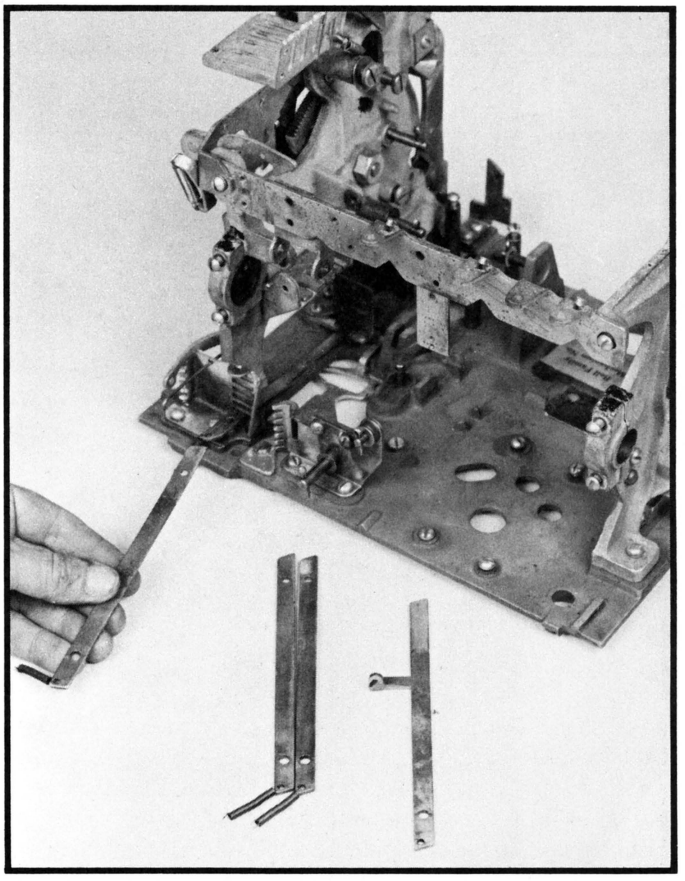


Figure 8.28

Assembly of the Mechanism from the Rear

First, the safety slide lever assembly is mounted to the base of the mechanism with its shoulder screw as shown in Figures 8.25 and 8.26. The extension spring is then connected between this lever and the base. The tension on this spring should be enough to keep the lever rotated to the right except for extreme jarring. For home use it is better to have too much tension rather than not enough.

Next the horizontal payout levers are inserted into the mechanism, from the bottom up, one at a time, as shown in Figures 8.27 and 8.28. When these levers were originally removed from the mechanism, they

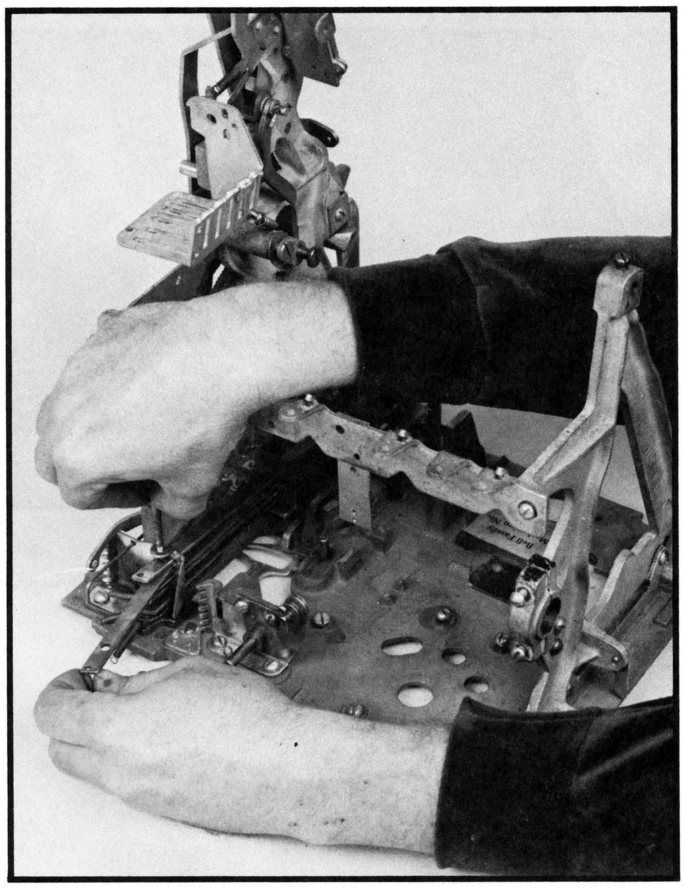


Figure 8.29

should have been coupled together with a piece of wire in order to preserve their relative order. These are inserted with the ends facing as shown in Figure 8.28. After all of the horizontal payout levers have been inserted into the mechanism, the pivot hole in each of them should be aligned such that the horizontal payout lever fulcrum can be inserted through the hole, as shown in Figure 8.29, and screwed into the base of the mechanism as shown in Figure 8.30. Once this fulcrum has been tightened, a lock nut is placed on it from underneath the base in order to prevent possible loosening of the screw during operation. Finally, the extension springs on the end of the levers are connected to the bracket to the left of them as shown in Figure 8.31. If a safety cover was present

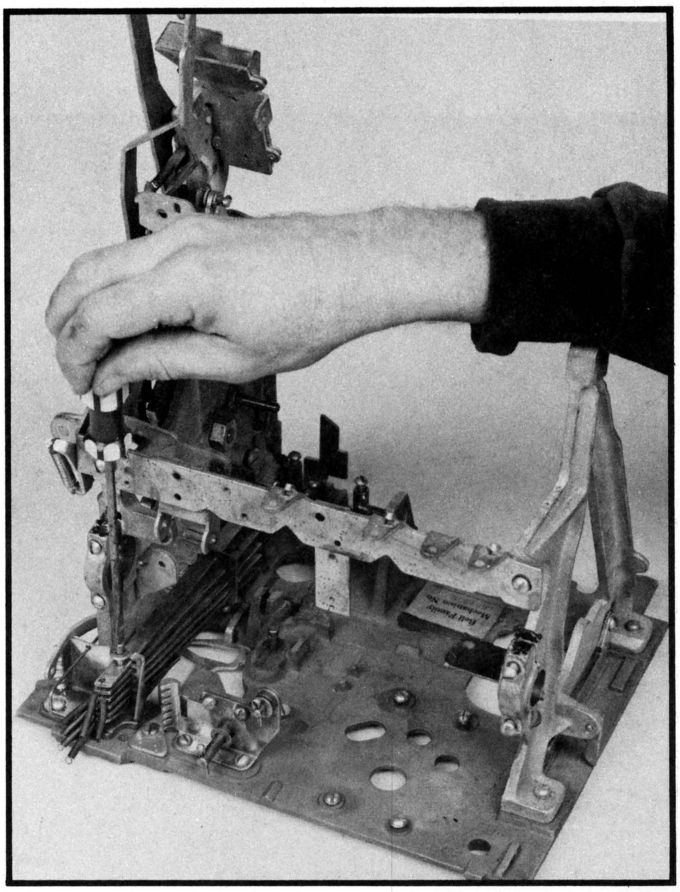


Figure 8.30

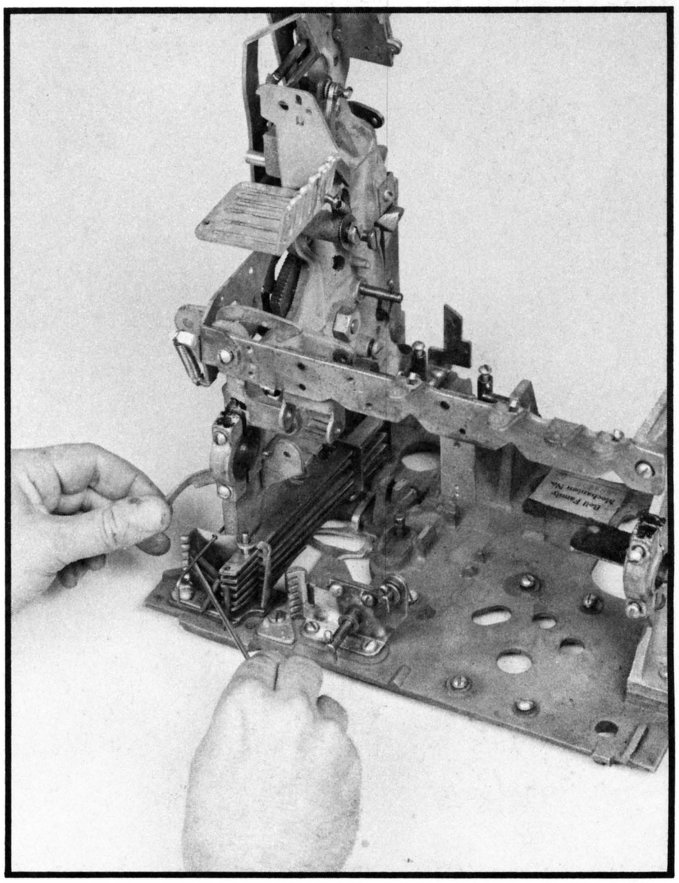


Figure 8.31

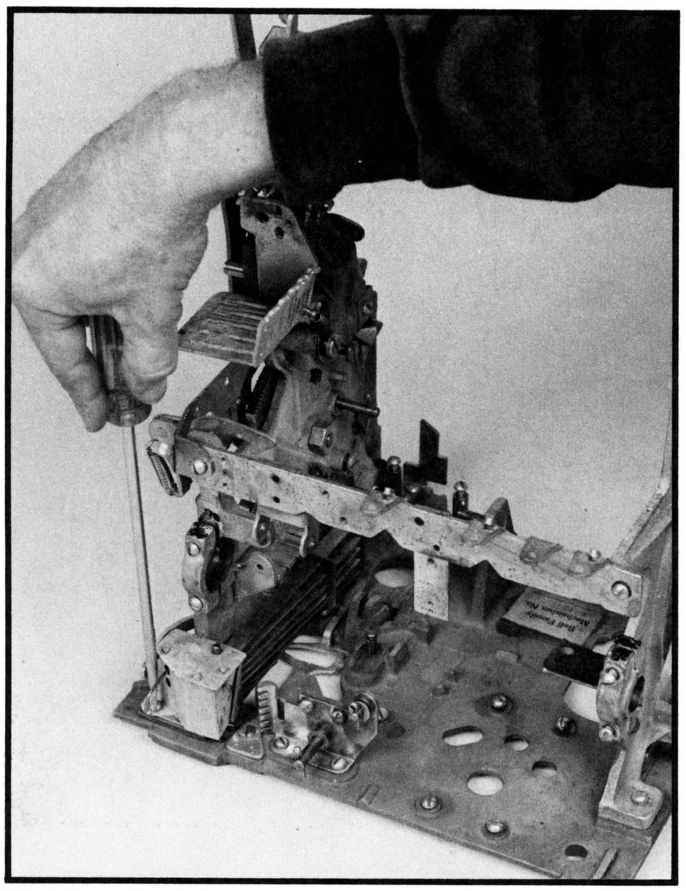


Figure 8.32

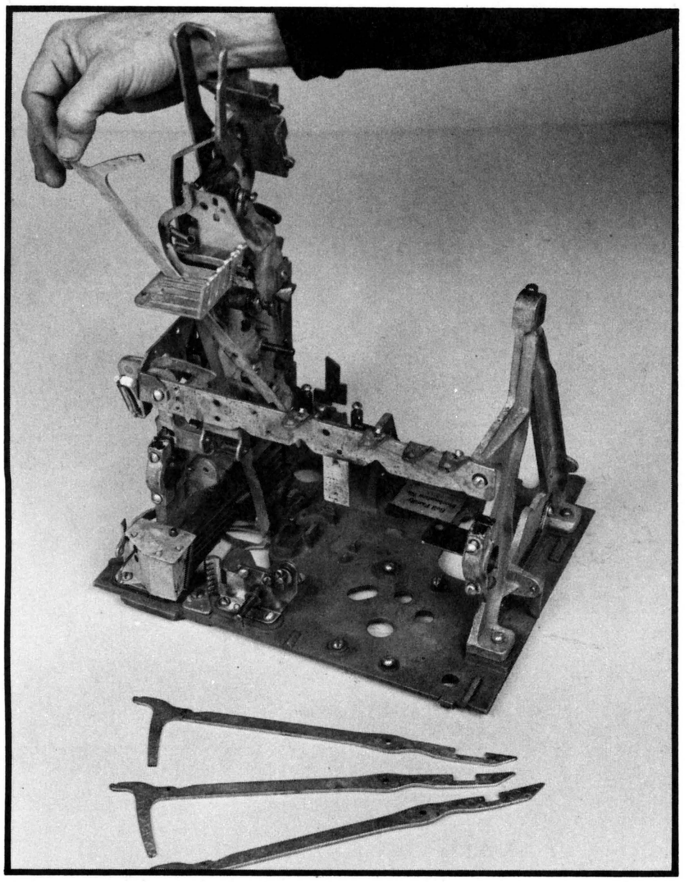


Figure 8.33

when the mechanism was disassembled, it should be connected to the base of the mechanism as shown in Figure 8.32.

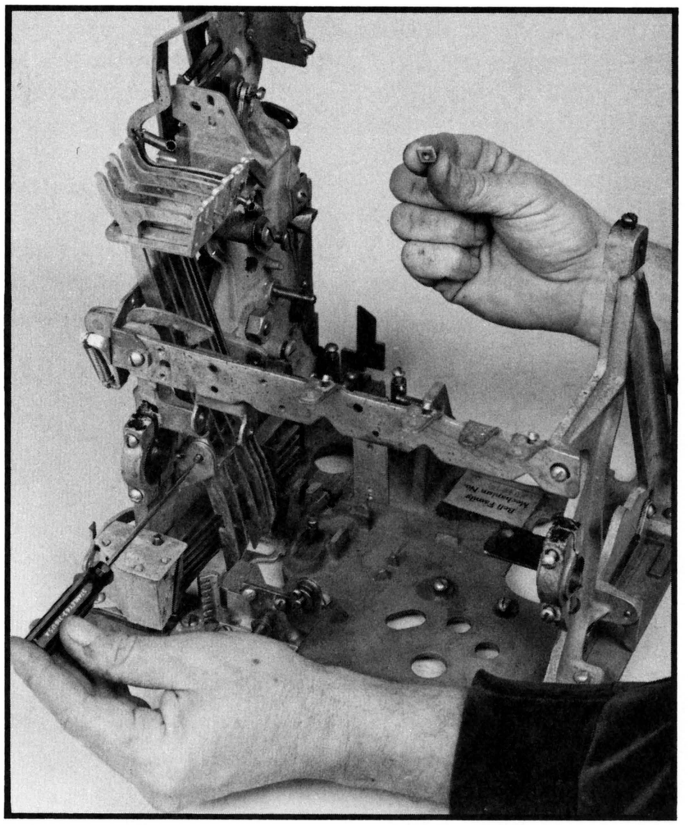


Figure 8.34

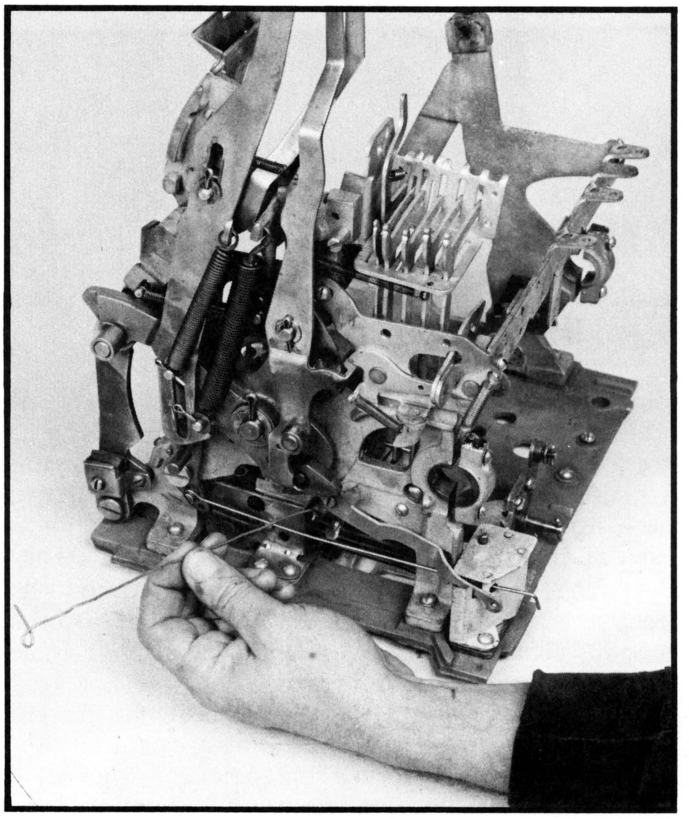


Figure 8.35

The next parts to be assembled into the mechanism are the vertical payout levers shown in Figure 8.33. These levers are installed one at a time through their bracket as shown until all six of them have been inserted and aligned. The order of these levers should have been preserved upon disassembly by having a piece of wire placed through their pivot holes. The jackpot lever, which has the extra extension on it for a spring, needs to be inserted first nearest the coin tube and a special spring added to it before it can be assembled. These levers are placed in order such that when replaced in the mechanism, the length of the shoulder at the bottom end of each lever should be of decreasing length as the levers are installed from the front toward the rear of the mechanism.

Once the levers have been inserted into their respective brackets, the fulcrum pin should be inserted through its bracket and the pivot holes in the levers and screwed in place as shown in Figure 8.34. The end of the fulcrum pin is secured by adding a lock nut to it to prevent the possible loosening of the pin during operation of the mechanism. At this point, all the levers should be perfectly free to move back and forth and be unobstructed by any other part. The first and most difficult spring to install is the jackpot spring which leads from the vertical payout lever to the horizontal payout lever as shown in Figure 8.35. The hand-fashioned spring hook will be a great assistance in installing this spring in its relatively hard-to-reach position. Next, the extension springs (finger springs) are installed between each of the vertical payout levers and their bracket guide as shown in Figure 8.36.

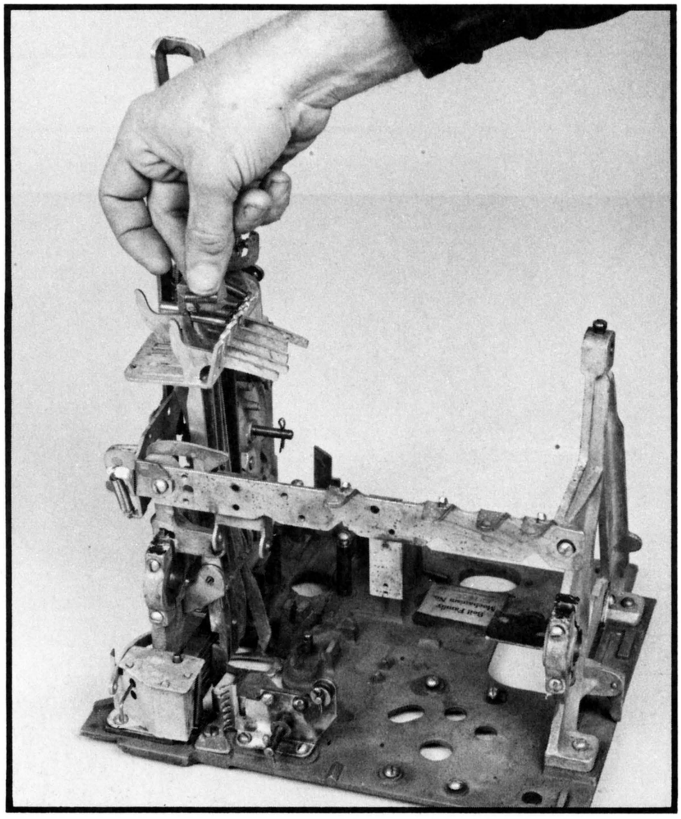


Figure 8.36

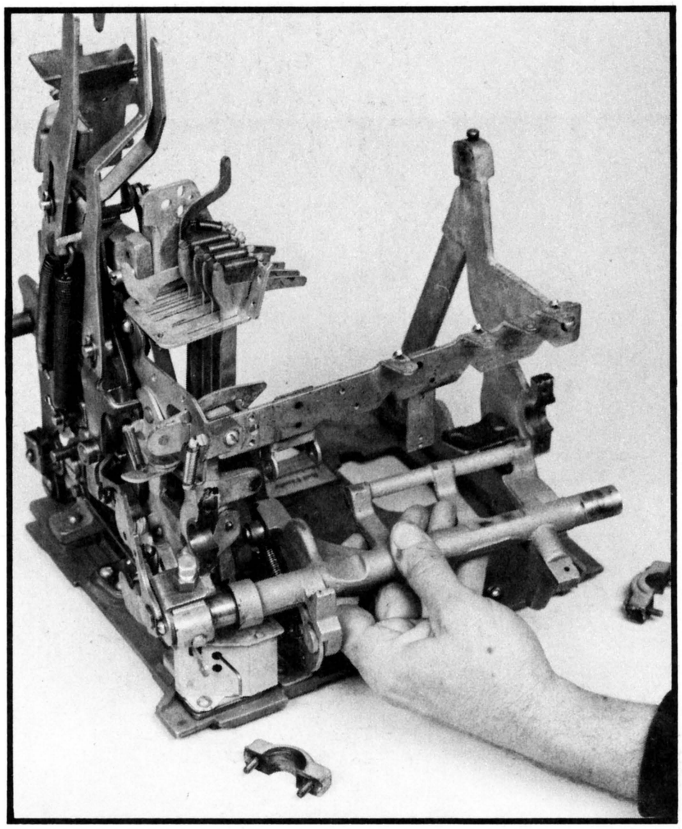


Figure 8.37

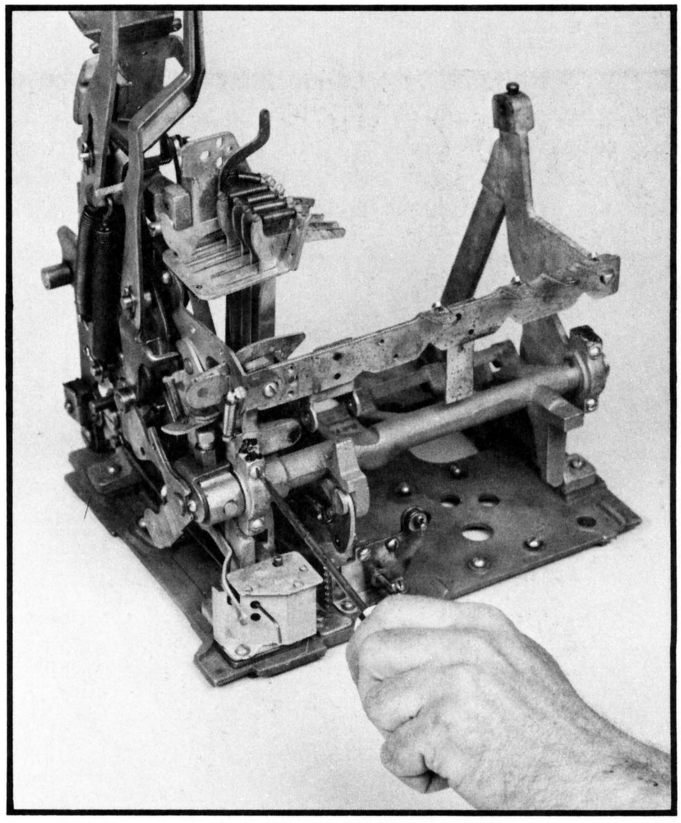


Figure 8.38

Next the operating fork is installed on the rear of the mechanism as shown in Figures 8.37 and 8.38.

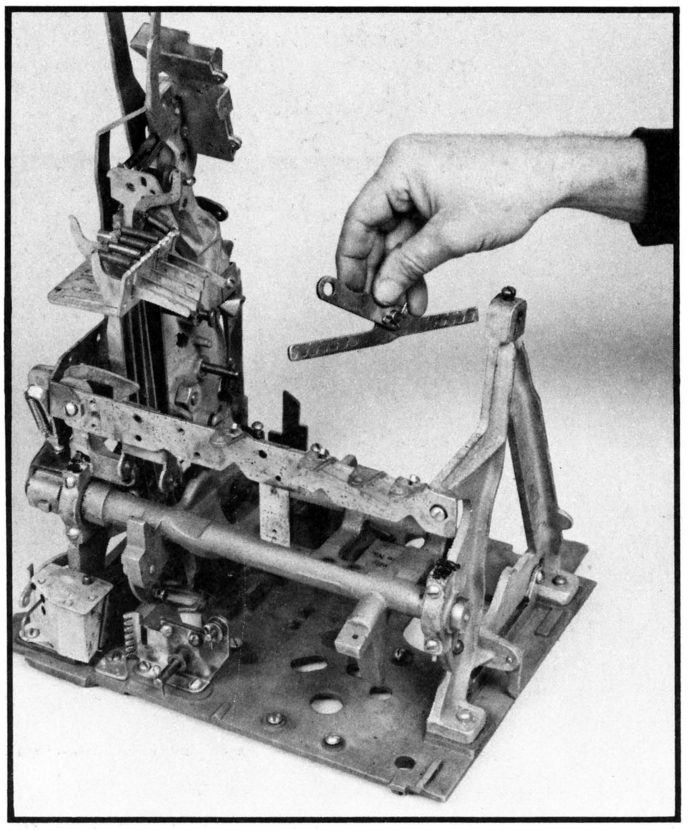


Figure 8.39

The bearing caps should have been secured with the frame during the cleaning operation. The tops of these caps should have been color coded with the frame to indicate which side was up and therefore replaced as they originally came off. These bearings should be thoroughly greased before the caps are installed. After the caps have been installed, this fork should be free to rotate in either direction.

Now the payout slide pushbar and its linkage arm are assembled into the mechanism as shown in Figures 8.39 and 8.40. The two guides holding the slide pushbar should be thoroughly lubricated with grease and the linkage arm attached to the operating fork. As the operating fork is rotated, the pushbar should freely move both forward and backward. Then the timing lever is replaced on its post as shown in Figure 8.41 and secured with its cotter pin.

Next the vertical payout pushback lever assembly is installed in the mechansim and secured by tightening its pin securely as shown in Figures 8.42 and 8.43. The

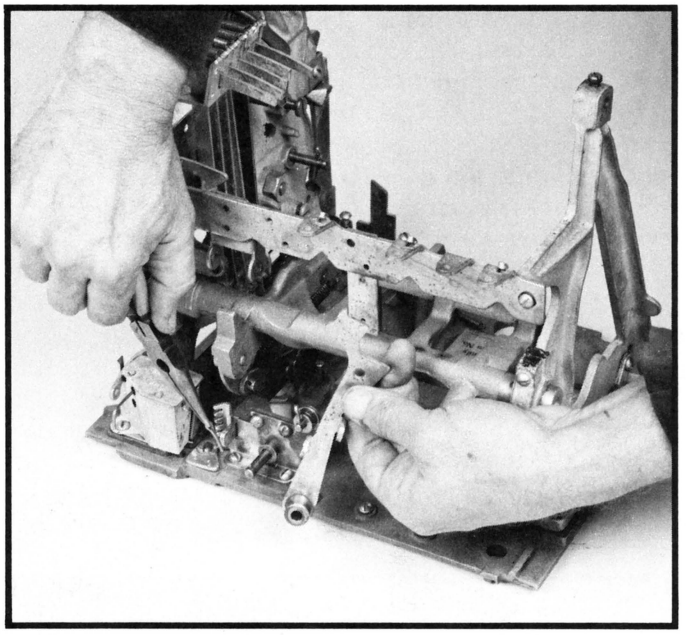


Figure 8.41

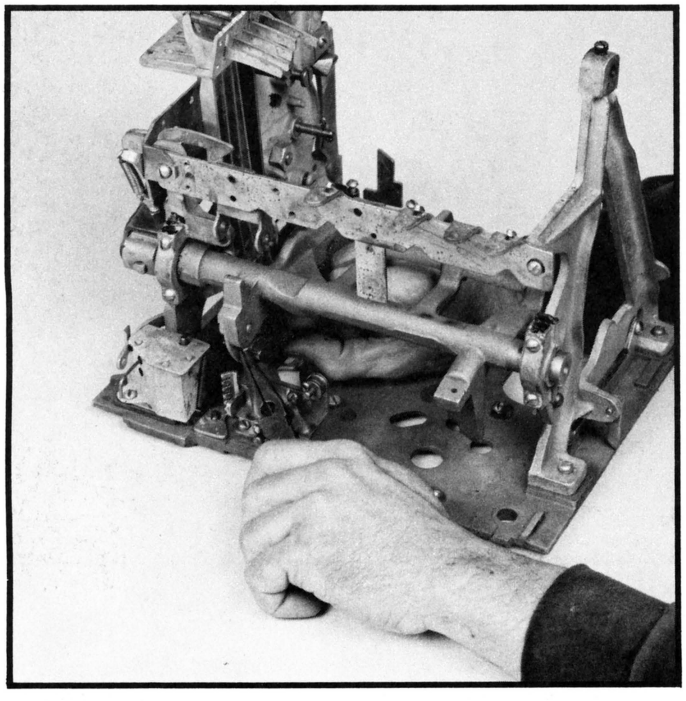


Figure 8.40

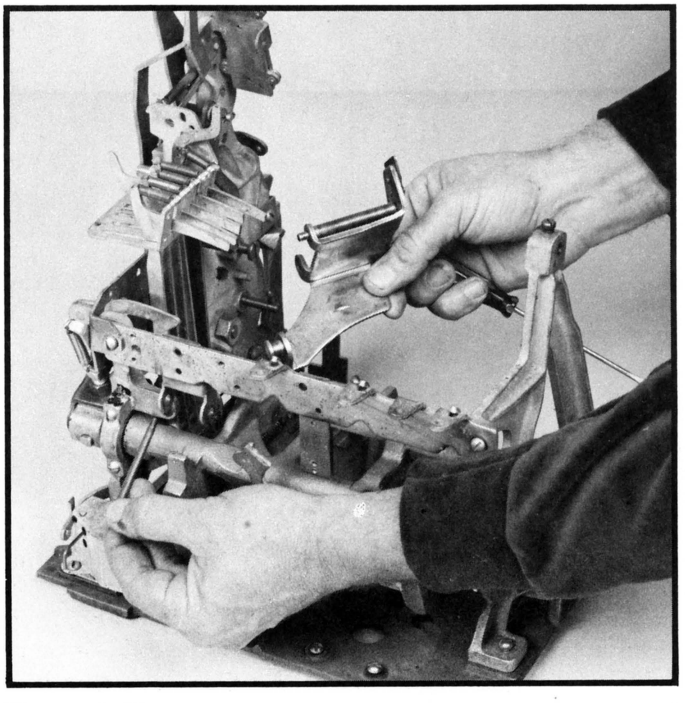


Figure 8.42

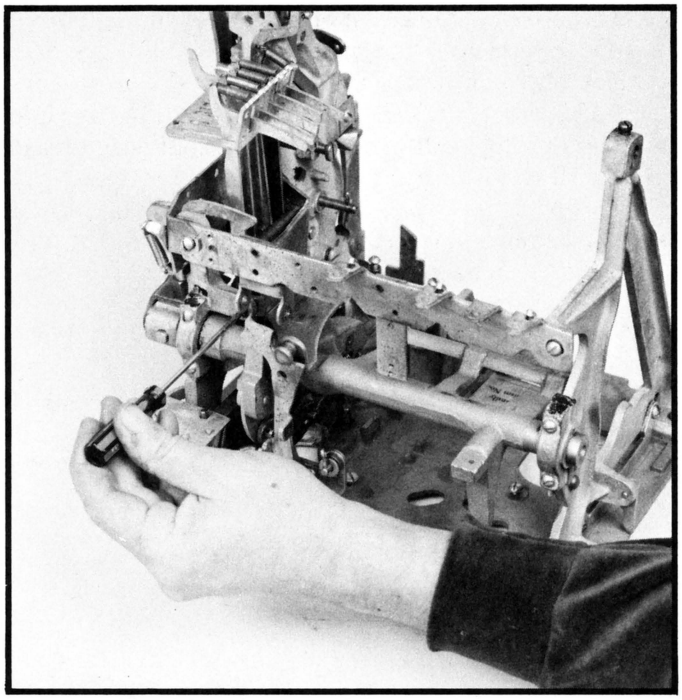


Figure 8.43

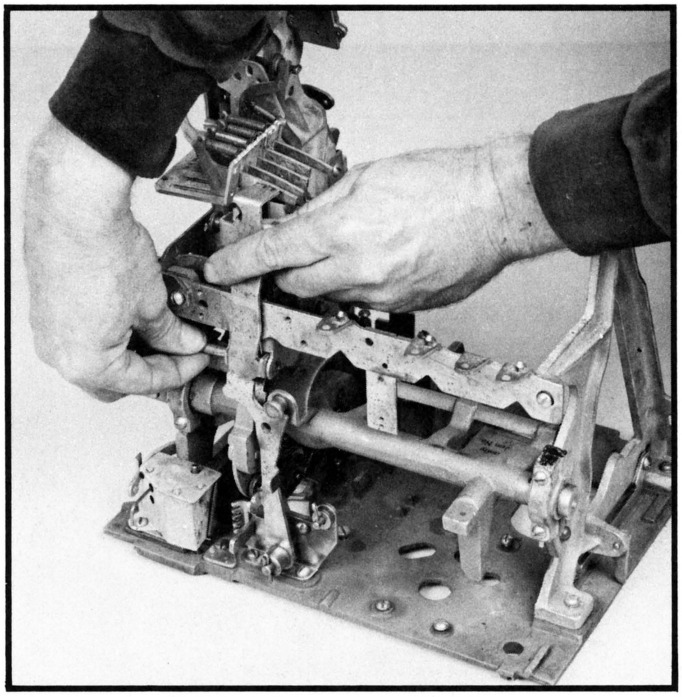


Figure 8.44

contacting surfaces of this lever with the timing lever should be thoroughly greased and both levers should be free to move relative to each other.

Now the disc stop lever and the award token release lever are installed by inserting their common pin through both levers and their mounting bracket and the pin secured using a cotter pin as shown in Figure 8.44. A little manipulation will be required in fitting these levers to the mechanism, since the award token release lever mounts from the rear side of the mechanism, while the reel disc stop lever mounts from the

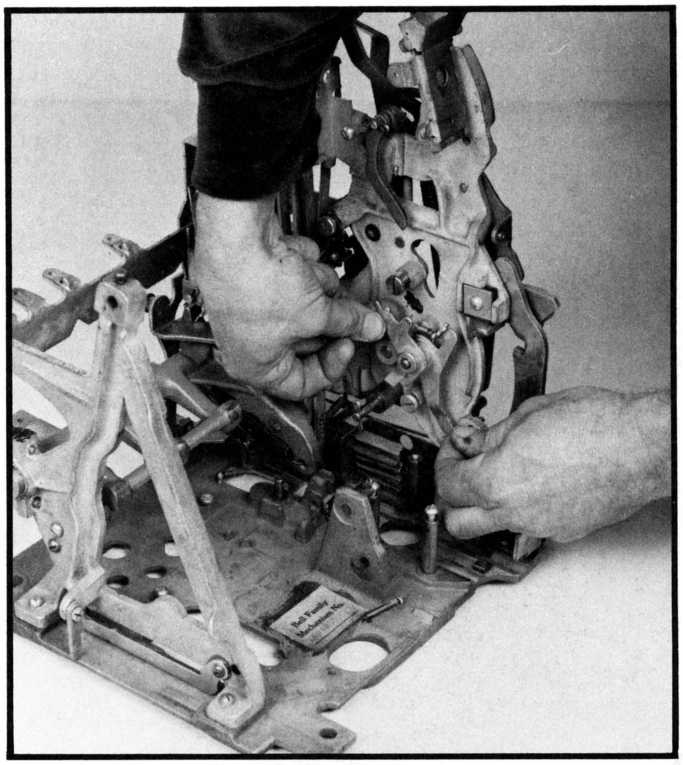


Figure 8.45

inside of the mechanism with its spring in between the mechanism bracket and the disc stop lever. By slowly pushing the pin into this assembly, each hole can eventually be worked around so that the pin can be pushed all the way through. After these two levers are assembled, the award token release lever should be free to move in either direction while the reel disc stop lever should be under spring tension and be pushed

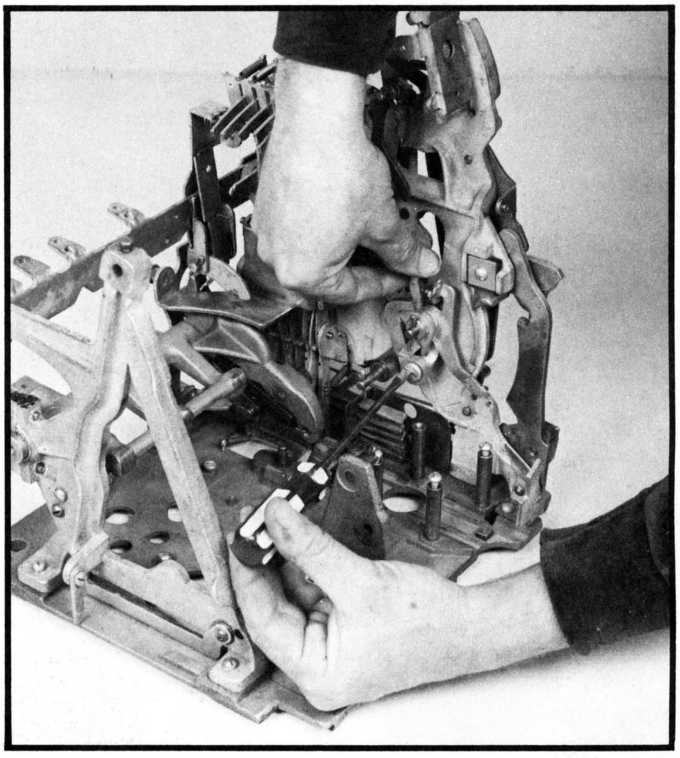


Figure 8.46

towards the front part of the mechanism. It should be noted that when the mechanism is in the ready position, the disc stop lever is held back towards the award token release lever by the operating fork.

The coin tube shutoff levers are installed as shown in Figures 8.45 through 8.48. First, the shutoff activator lever is mounted on its shaft and then the shutoff latch lever is mounted on the same shaft and the small

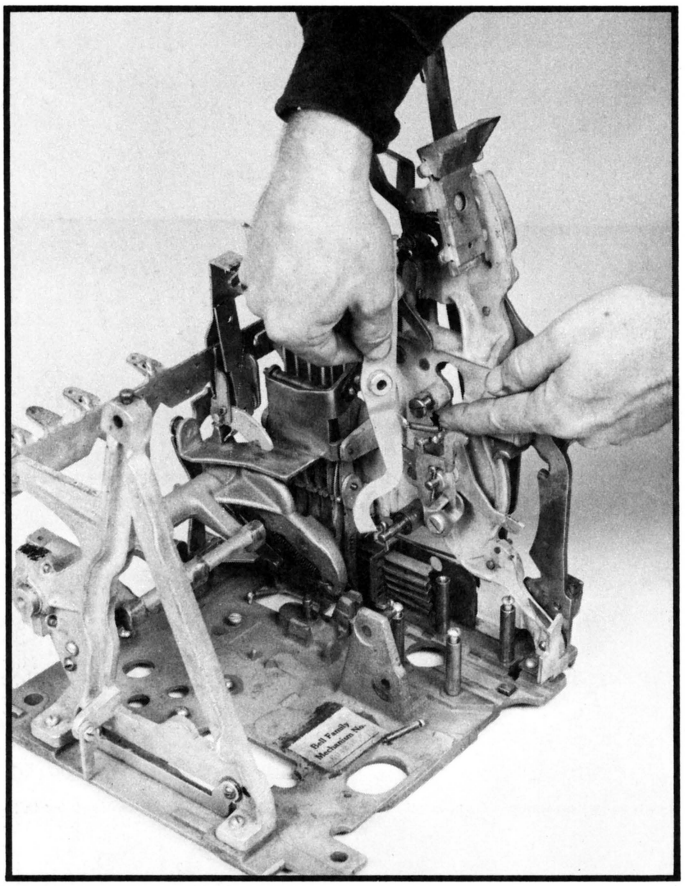


Figure 8.47

extension spring connected between these two levers and finally the two levers secured on the shaft by a washer and a cotter pin as shown in Figure 8.45. The check tube shutoff detection lever assembly is then mounted to the mechanism with its shoulder screw as shown in Figure 8.46. Care should be taken when installing these levers, to preserve their relative positions with respect to each other in order to insure proper operation. It is also imperative that all of their bushings are very clean and free to operate. Finally, the coin tube shutoff lever is installed in the mechanism with its shoulder screw as shown in Figure 8.47 and 8.48. The completed assembly of the four levers should be checked for proper operation by manually holding the coin tube shutoff detection lever and the shutoff activation lever and simulating a jackpot by moving the coin tube shutoff lever to its forward position.

Next the award token release pushbar is installed by mounting it to the detection lever with one

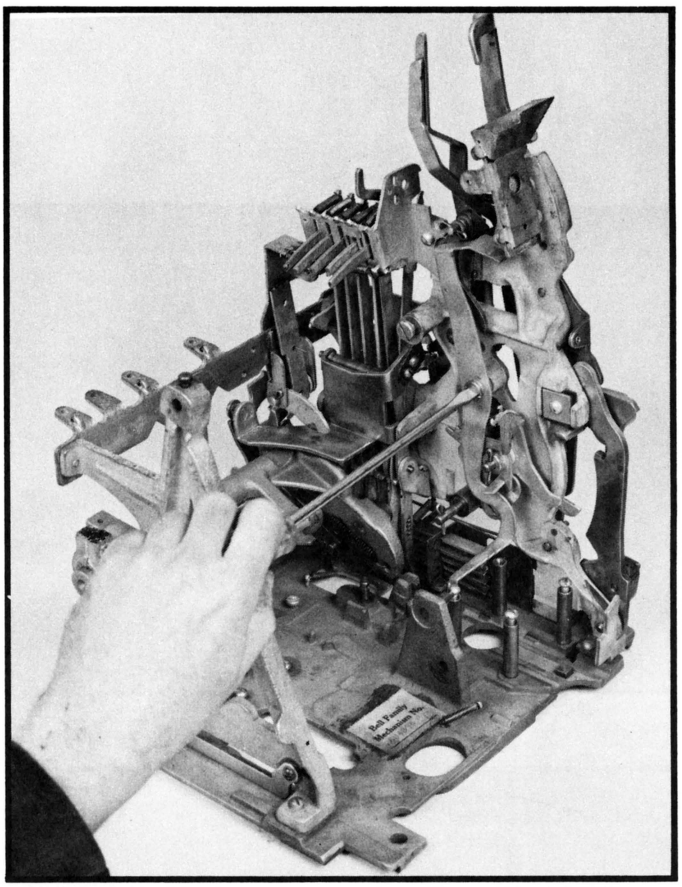


Figure 8.48

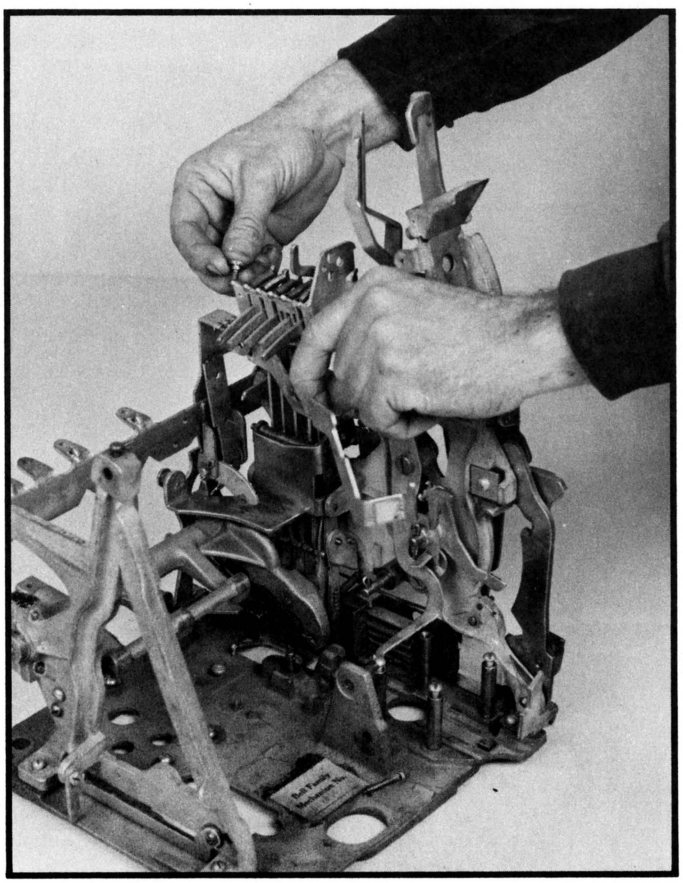


Figure 8.49

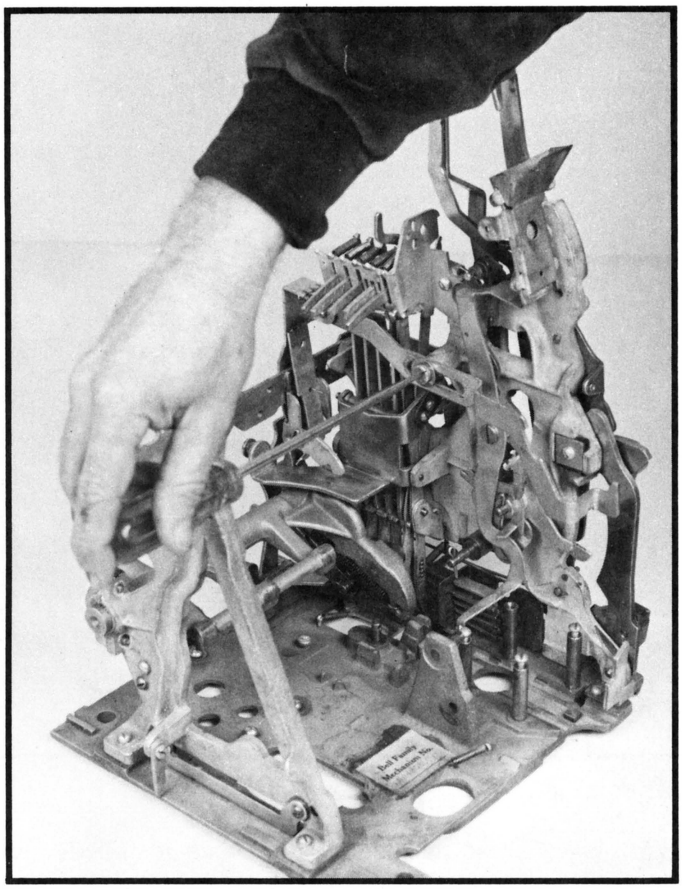


Figure 8.50

shoulder screw and to the frame with another shoulder screw as shown in Figures 8.49 and 8.50. The extension spring is then connected to the pushbar which leads from the guide bracket of the vertical payout levers. This pushbar assembly should freely move back and forth with the spring providing tension to keep it in the forward position.

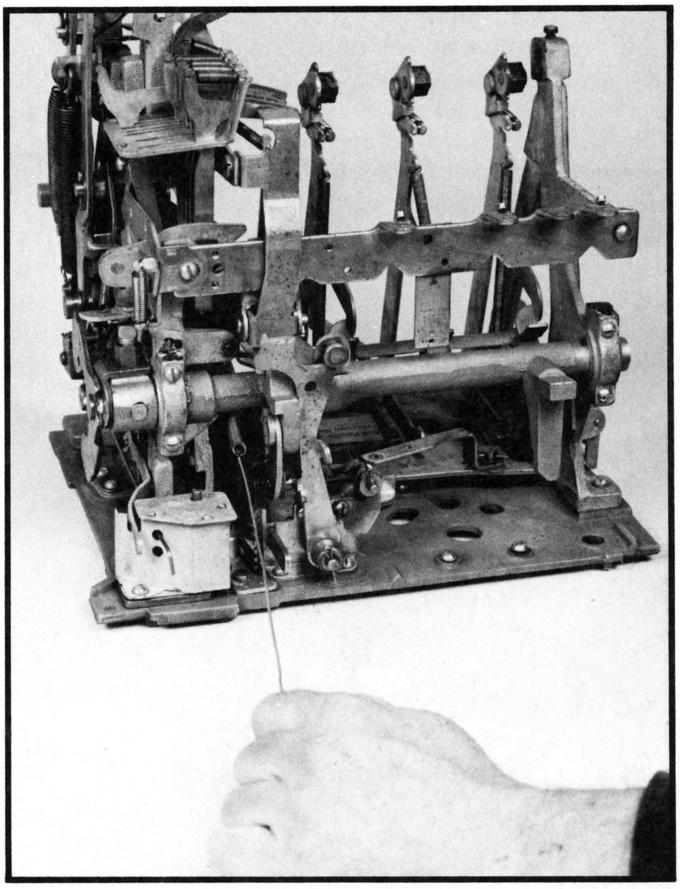


Figure 8.52

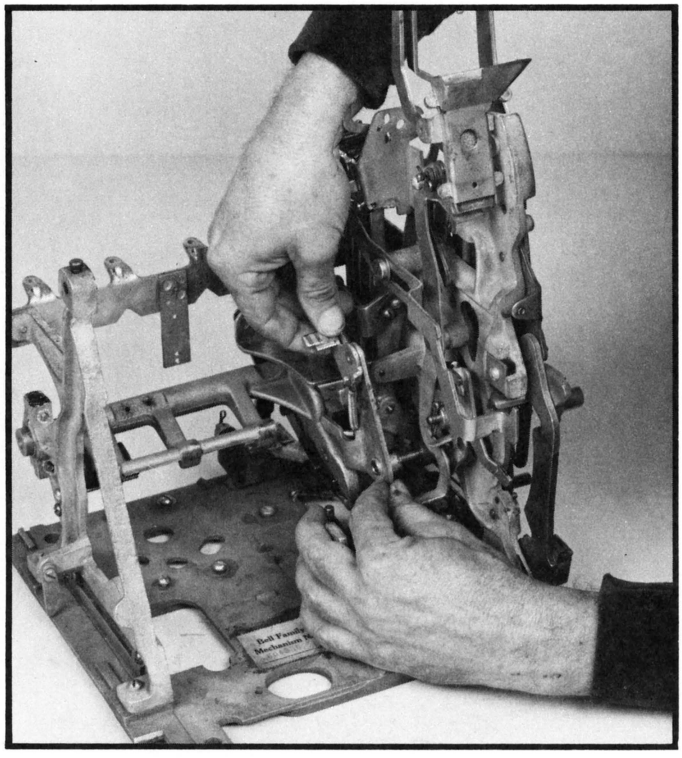


Figure 8.51

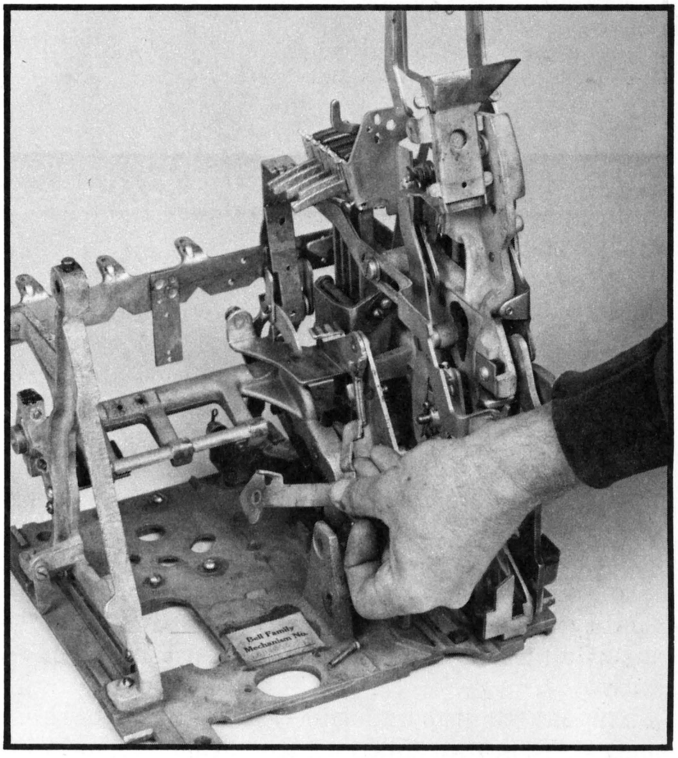


Figure 8.53

Now the reel operating lever assembly (kicker) is installed as shown in Figures 8.51 and 8.52. After the reel operating lever assembly has been installed, its extension spring is connected to the bracket at the rear of the mechanism. This bracket will eventually hold the springs on the payout slides. The surface of this lever that makes contact with the bearing on the operating fork should be thoroughly greased and the mechanism cycled several times to insure proper operation of the kicker mechanism. The small extension of the lever arm which actually has the plate which makes contact with the discs should be checked for excessive wear which can be evidenced by three grooves. These grooves can lead to a deteriorating condition in the operation of the mechanism. If this plate shows excessive wear, it should either be re-

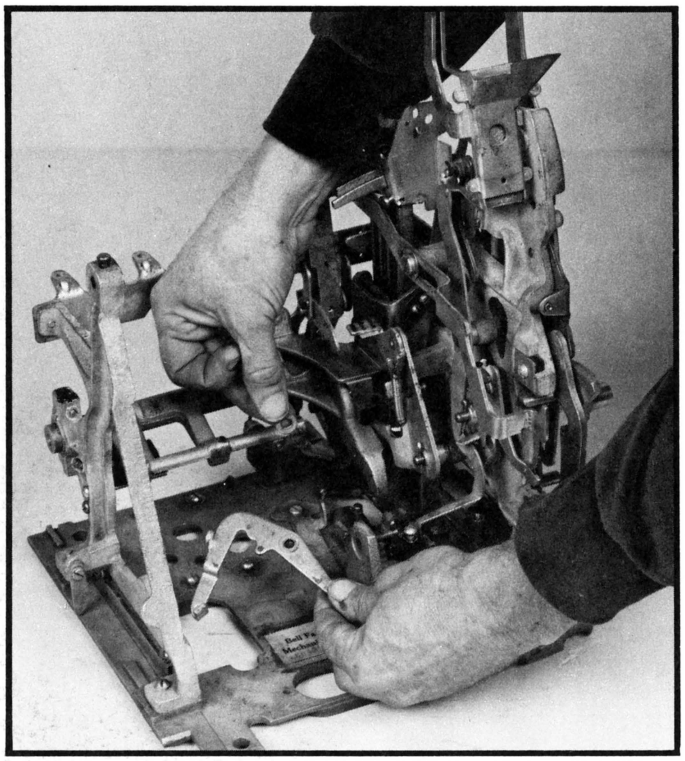


Figure 8.54

placed or filled in with welding rod and made smooth again to provide a clean solid surface for kicking the three reel discs.

The payout slide stop lever is mounted to the base of the mechanism with its shoulder screw as shown in Figure 8.53. As mentioned previously, this part serves only a minor maintenance function in the mechanism and is not essential to its operation.

The payout slide lock lever is mounted to its shaft as shown in Figure 8.54. After this lever has been placed in position, a small spacer washer should be placed on top of the shaft before installing the next lever.

Now the reel stop timing lever is placed on the same shaft as the payout slide lock lever and is secured by a washer and cotter pin as shown in Figures 8.55 and

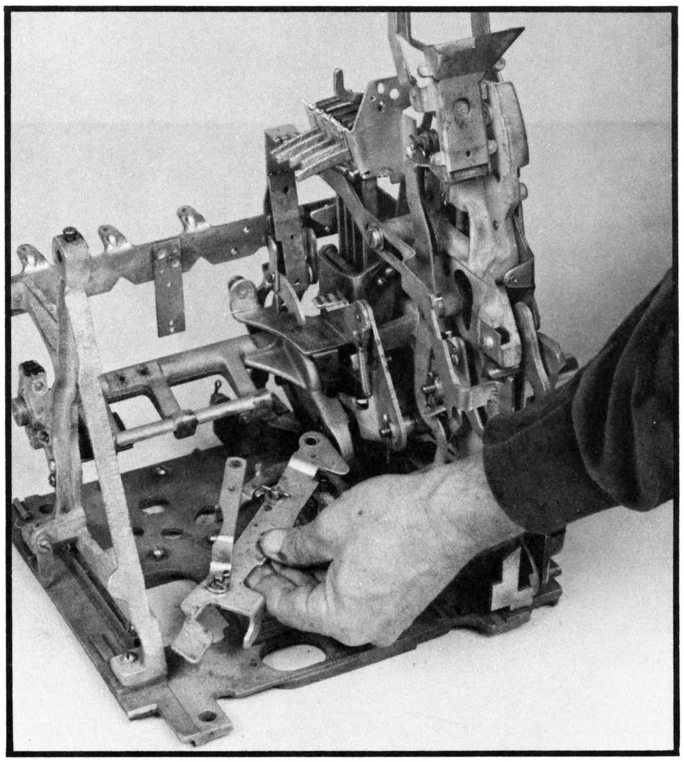


Figure 8.55

8.56. After these two levers have been installed, the extension spring connecting them should be securely fastened between the two of them. It is important that this spring is securely mounted on each of the levers since it provides a vital function of the mechanism's operating capability; if one end becomes loose, it will prevent payouts from occurring in the mechanism.

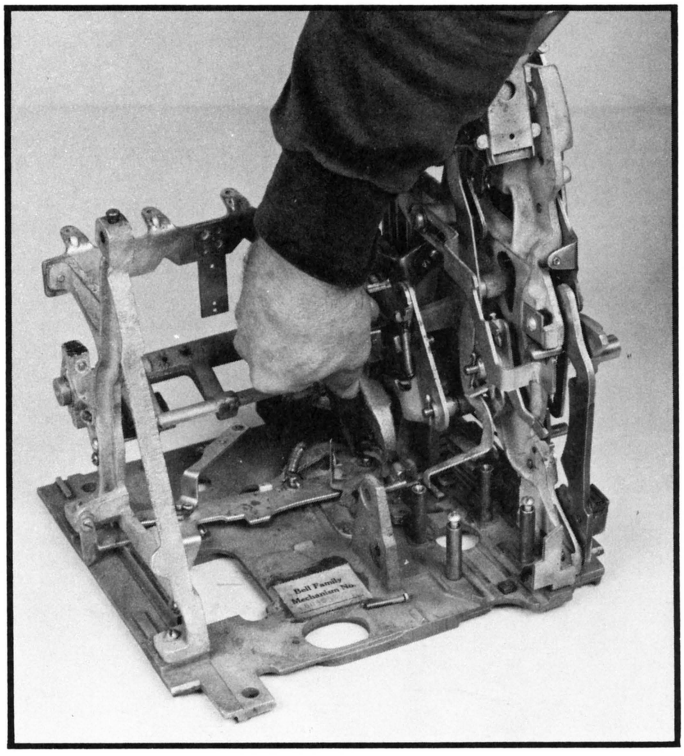


Figure 8.56

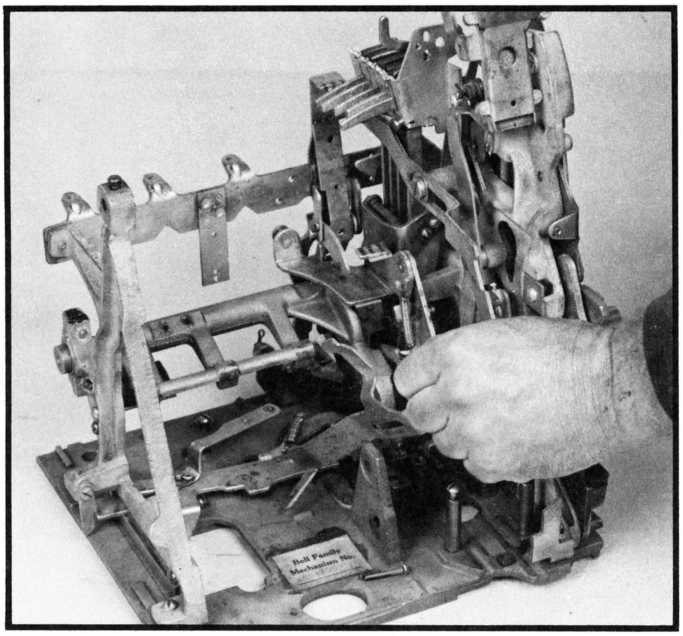


Figure 8.57

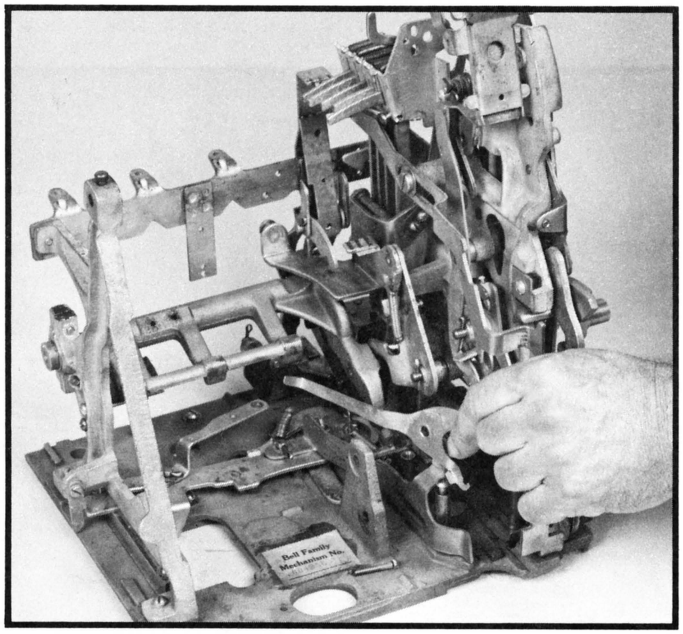


Figure 8.58

The jackpot pushbar lever is installed by connecting one end of it to the reel stop timing lever as shown in Figure 8.57. The other end of this lever will remain free until further assembly of the slide stack is completed later on.

The fan stop lever assembly is connected to the frame of the mechanism with its shoulder screw as shown in Figure 8.58. Once the lever has been secured, the small extension spring is connected between this lever and the base of the mechanism to keep it in its normal or up position.

Finally, the reel stop levers are installed, one at a time, by inserting their shaft through them from the left-hand side of the mechanism as shown in Figure 8.59. Use of the reel stop lever spacer bushing between the first and the second reel stop lever. This bushing is installed while the rod is being inserted. After the three levers have been secured by the main shaft, the shaft should be secured to the frame by the cotter pins at each end of the shaft.

This completes the assembly of the mechanism up

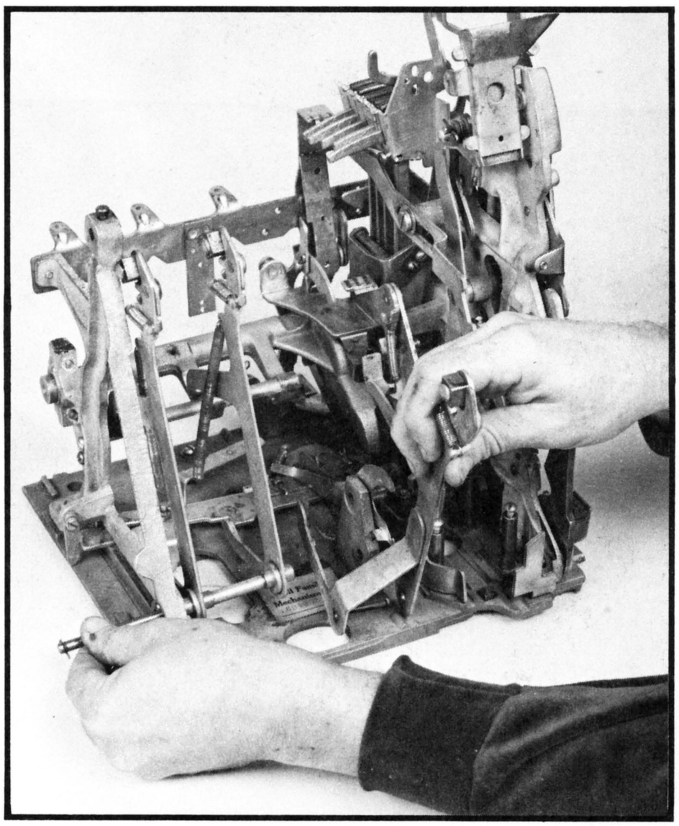


Figure 8.59

to the stage where it was left during its cleaning as described in Chapter 5. By performing the steps in Chapter 5 for reassembly of the clock, coin tube and payout slides, the total assembly of the mechanism can be completed.

9 The Reel Assembly

Theory of Operation

Figure 9.1 is a front view of the reel assembly, sometimes called the reel bundle, after it has been removed from the operating mechanism. Each of the three reels are connected to a payout disc by a set of concentric shafts. If the shafts have been cleaned and oiled, there will be very little friction between the three reels, hence their spinning will be relatively independent of each other.

The reels are simultaneously set in motion by the reel operating lever assembly pushing against the reel discs during the release cycle described previously.

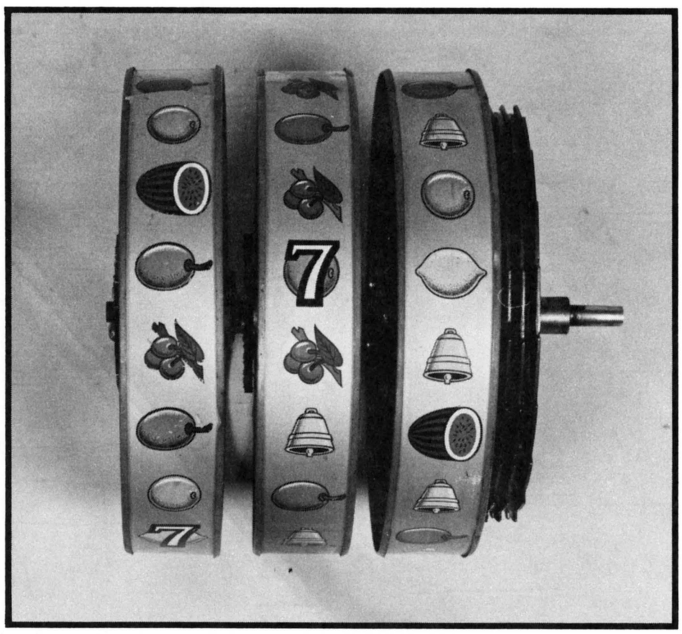


Figure 9.1

The three reels are allowed to spin for a few seconds, and then the reel stop levers sequentially engage the starwheels mounted on the reel hubs of the three reels causing the random stopping of the three reels.

The interpretation of what symbols have appeared on the payout line is accomplished by the vertical payout levers attempting to poke their way through the reel discs.

Figure 9.2 shows the side view of the reel disc corresponding to the first reel. On the periphery of this disc are twenty (some later machines had as many as twenty-five) sawteeth, each sawtooth corresponding to a possible stopping position of the reel. It is these teeth that are engaged by the reel operating lever to set the reels spinning during the release cycle.

On this disc there are nineteen elongated holes, each one corresponding to a particular symbol on the reel. While there are twenty symbols on the reel, this reel has one lemon which generates no payout, and consequently no hole is needed. Note, however, that on the outer edge of the disc shown in Figure 9.2 there is a notch which corresponds to the special award token payout, which is indicated on the reel strip by the symbol 7. On the first reel this 7 is underlain by a lemon, as shown in Figure 9.1, and this lemon correspondes to the missing hole in the same area of the disc. The radial distance of these holes from the center

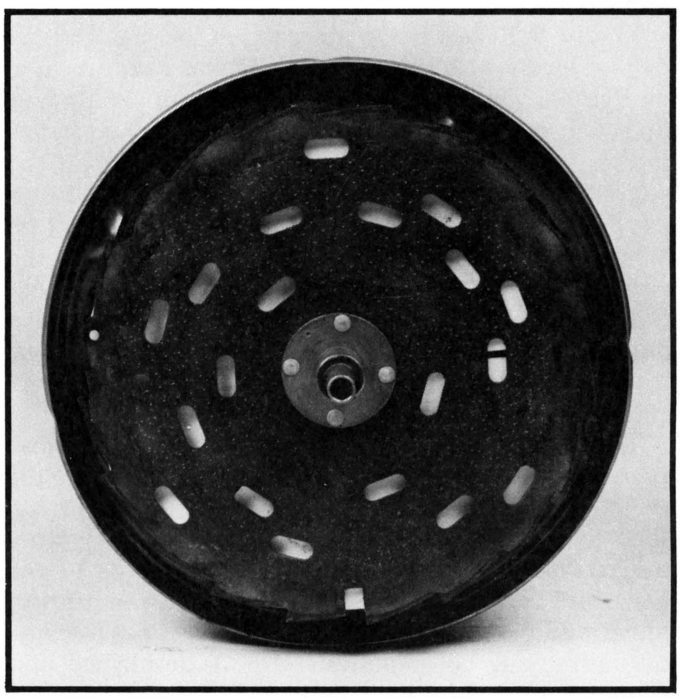


Figure 9.2

of the disc corresponds to the particular symbol on the reel. In general, the higher the payout, the closer the hole is to the center of the disc. Lemons are represented by the absence of a hole except on the third disc where they may be part of a special award such as two cherries and a lemon.

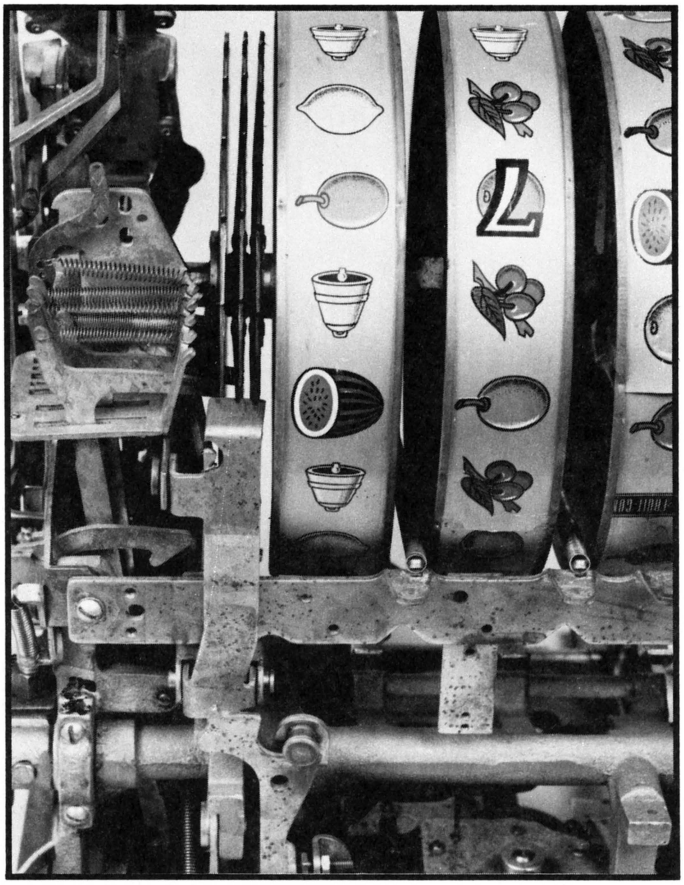


Figure 9.3

Figure 9.3 shows the interaction of the vertical payout levers with the reel discs. In this example, one orange has appeared on the first reel on the payout line, and consequently the vertical payout lever has moved forward into the corresponding hole on the payout disc which is in front of it while the other payout levers are inhibited from any forward motion. When three oranges occur on the payout line, then the vertical payout lever corresponding to oranges penetrates all three reel discs as shown in Figure 9.4. This motion of the vertical payout lever then causes the horizontal payout levers to release enough slides to account for a ten coin payout.

There can be more than one hole on the reel disc corresponding to a given symbol. This is the case for the bar which is "wild" on the third reel. Figure 9.5 shows the disc corresponding to the third reel. Note the large rectangular hole which corresonds to the bar; this enables the bar to also appear as an orange, plum, and bell. Mystery payouts (intentional payouts on non-paying combinations) are accomplished in a similar manner by punching multiple holes for a given symbol.

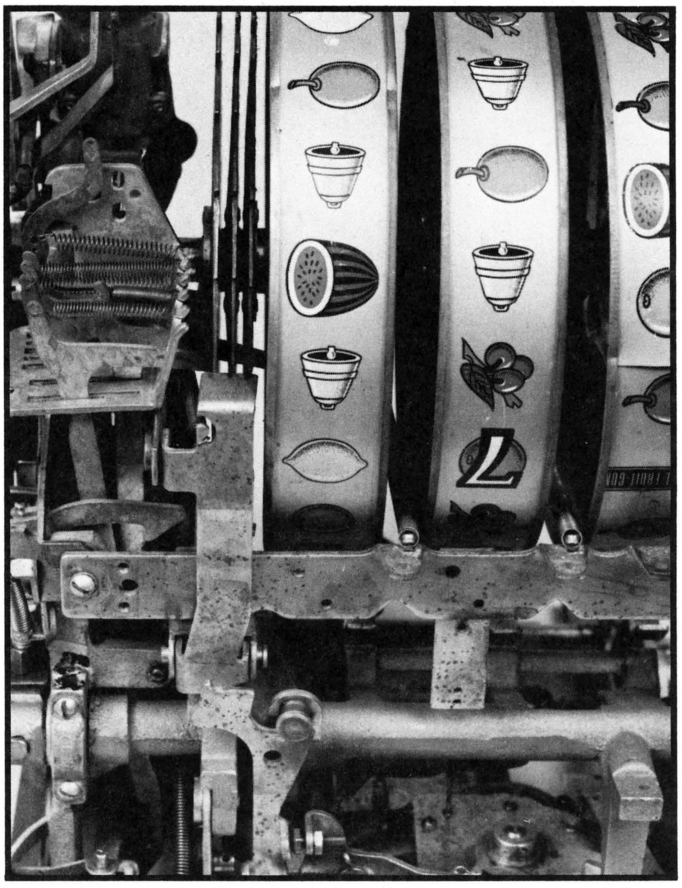


Figure 9.4

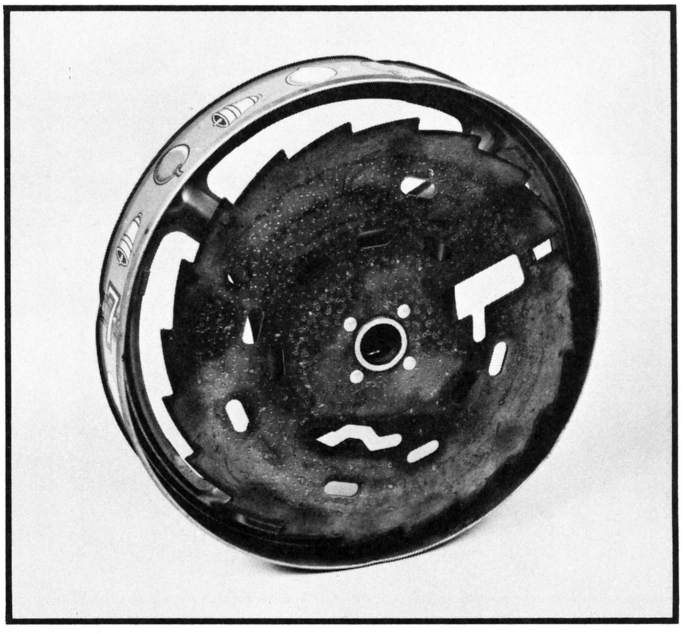


Figure 9.5

The special 7-7-7 award is accomplished independently of the payout levers. The large notch shown on the disc in Figure 9.2 corresponds to a "7". It is these notches which are sensed by the award token release lever as shown in Figure 9.6, thus allowing the award token release pushbar to travel forward and thereby release a special award token.

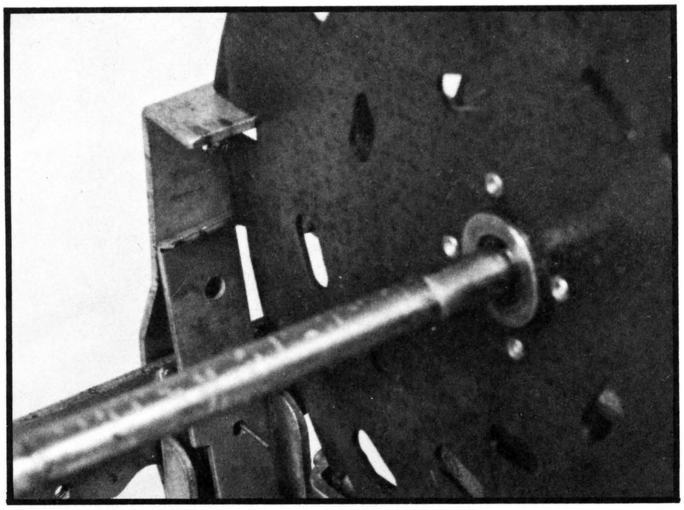


Figure 9.6

Mechanism Statistics

The statistical payout of the slot machine is determined by the payout card and the reel strips, assuming the three reels are random and all symbol positions are equally likely to occur. The method presented here in determining the payout statistics is simple and straightforward and can be used on almost any machine.

First take an inventory of the three reels as to the type and number of each symbol, and record the results as shown in Table 9.1. For the time being, ignore the "7" overlays, since they represent a bonus in addition to the regular payouts (this is true only because the 7-7-7 payout does not involve the coin tube or jackpot payouts).

Once the symbol inventory table has been completed, check to make certain each reel has accounted for 20 symbols (the total number of stopping positions for each reel).

The next step is to complete the number of ways each winning combination may occur. This is done by multiplying the number of ways on reel 1 times the number of ways on reel 2 times the number of ways on reel 3; this computes the total number of ways for each winning combination. These calculations can be entered into Table 9.2 as shown under "Number of Ways".

Table 9.2 is completed by multiplying the total number of ways of each winning combination by the amount paid when it occurs. The total paid column in Table 9.2 is this product. By adding up this column,

SYMBOL INVENTORY TABLE

Symbol Description	Reel 1	Reel 2	Reel 3
Lemon (L)	1	None	5
Cherry (C)	3	6	None
Orange (O)	5	4	2
Plum (P)	7	3	3
Bell (B)	1	5	8
Watermelon (W)	1	1	1
Bar (—)	2	1	1
Totals	20	20	20

Table 9.1

PAYOUT COMPUTATION

WINNING COMBINATIONS			NUMBER OF WAYS				PAYOUT AMOUNTS	
Reel 1	Reel 2	Reel 3	Reel 1	Reel 2	Reel 3	Total	Amount Paid	Total Paid
C	Any	Any	3	14	20	840	2	1680
C	C	Any	3	6	20	360	5	1800
O	O	O	5	4	2	40	10	400
O	O	—	5	4	1	20	10	200
P	P	P	7	3	3	63	14	882
P	P	—	7	3	1	21	14	294
B	B	B	1	5	8	40	18	720
B	B	—	1	5	1	5	18	90
W	W	W	1	1	1	1	20 + JP	20 + JP
W	W	—	1	1	1	1	20 + JP	20 + JP
—	—	—	2	1	1	2	20 + JP	40 + 2(JP)
O	W	O	5	1	2	10	10	100*
O	W	—	5	1	1	5	10	50*
								6296 + 4(JP)

*The "Mystery Payout" occurs because the watermelon on the 2nd reel is also punched like an orange on the reel disk.

Table 9.2

the total coins paid per 8,000 plays is computed and it is the ratio of this sum divided by 8,000 that is the percentage of coins returned to the player. The basic premise used in this computation is that there are 8,000 ways in which the reels can stop (20 x 20 x 20) and that statistically each combination should occur once in 8,000 plays. Thus the total number of coins paid out during the 8,000 plays divided by the number 8,000 gives the fractional payout.

The computation of the percentage paid on this machine is derived by multiplying the quotient by 100. Thus: % Returned = 100 x (6296/8000 + 4 x Jackpot/8000) = 78.7% + Jackpot/20.

The actual amount of the jackpot will vary in a self loading jackpot due to the fullness of the jackpot, the denomination of the coin used and the physical size of the jackpot itself. For this machine, a typical jackpot holds 130 coins. For front loading jackpots or "house paid" jackpots, the amount is predetermined by the operator (normally 150 coins). Thus the total percentage paid (excluding the 7-7-7 bonus) is 78.7% + 6.5% = 85.2%.

The bonus of 7-7-7 occurs once in 8,000 plays and it pays 200 coins thus contributing an additional

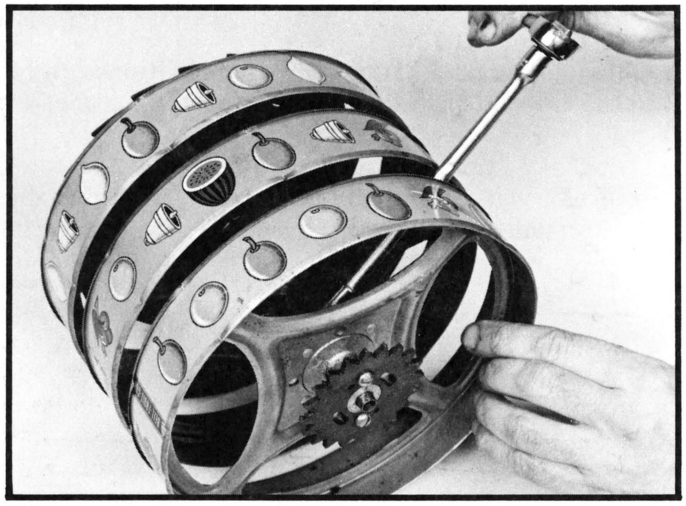


Figure 9.7

200/8000 or 2.5%. Thus the total percentage paid can be summarized as follows:

Fruit	78.7%
Jackpots	6.5%
7-7-7	2.5%
Total	87.7%

Disassembly and Cleaning of Reel Assembly

The reel assembly is disassembled by loosening the two nuts on each of the two hubs of the reel asembly with an extension socket wrench as shown in Figure 9.7. It should be noted that the wrench used must be as narrow as possible in order to maneuver it between the two adjacent reels. Once the nuts have been loosened on the hubs, the reels may be removed, one at a time, from their shafts as shown in Figures 9.8 and

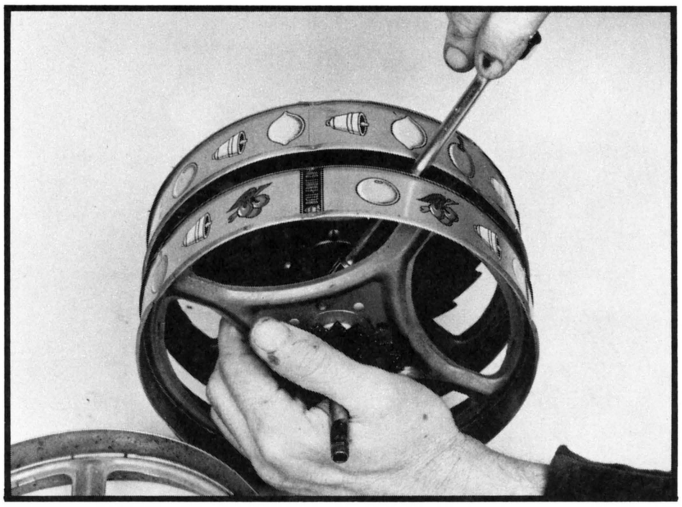


Figure 9.8

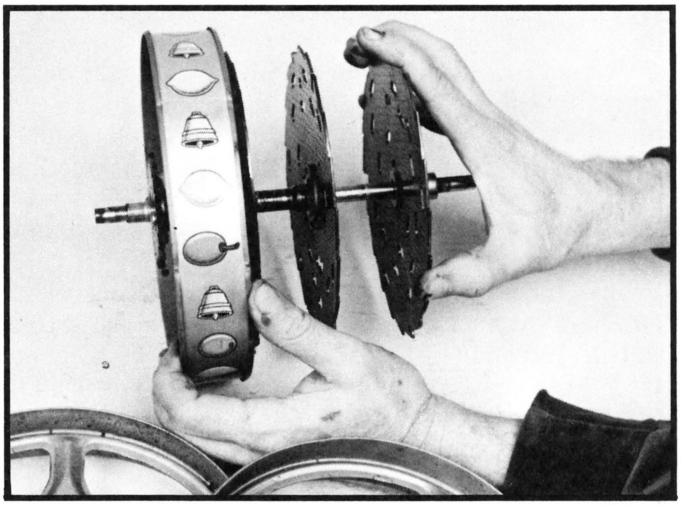


Figure 9.9

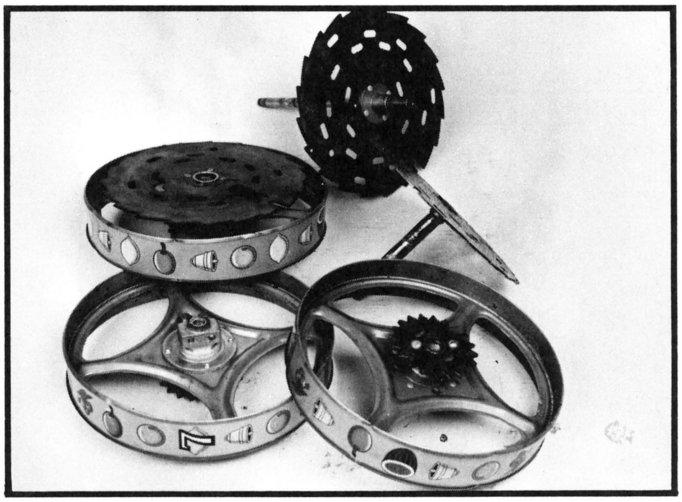


Figure 9.10

9.9. Figure 9.10 shows the reel assembly disassembled as far as it can be without removing the starwheels or any rivets.

At this stage, the five component pieces of the reel assembly may be cleaned by either removing the reel

strips themselves — in which case each separate piece could be washed down thoroughly with solvent and cleaned; or if it is desired to leave the reel strips in place, the three reels must be cleaned carefully so as not to soil the reel strips. It is important in the cleaning process to thoroughly clean the inside and the outside of the shafts on the three separate reel discs since it is these areas which normally accumulate the dirty grease and sludge which slow down the spinning of the reels. After the reels have been thoroughly cleaned, grease should be applied to each of the star stop gears on the reels and light machine oil applied to the inside and outside of the three shafts and bearings.

The reel assembly can be reassembled by reversing the process used in the previous part of this section. The bolts should not be tightened until the reel assembly has been inserted back in the mechanism and aligned. The method for aligning the reels will be covered in detail later in this chapter.

Reel Strip Removal and Replacement

As mentioned previously in this chapter, it is desirable to remove the reel strips for thorough cleaning of the reels, as well as changing the reel strips if new or reproduction ones are available. In the case where the reel strips are to be removed and reused it is important that they are handled carefully so as not to damage them while either removing or replacing them. The procedure outlined in this chapter attempts to minimize the possibility of damage. While the reel strips may be removed from the reels with the reels either assembled or disassembled the example shown here is with them disassembled.

The first step in removing the reel strips is to carefully pry up all the crimps on the rim of the reel, away from the paper as illustrated in Figure 9.11.

Before any attempt is made to remove the reel paper from the reel, a mark should be placed on the reel indicating where the end of the reel strip lies since this will be useful when it comes time to replace the paper on the reel. It is also useful to mark the reel strips in some way to distinguish them from each other (if they have not already been marked). This way when replacement time comes, there will be no confusion as to which strip went with which reel.

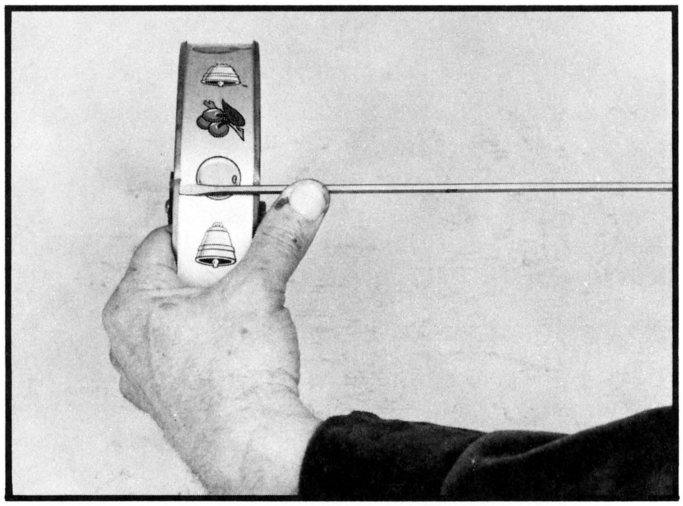


Figure 9.11

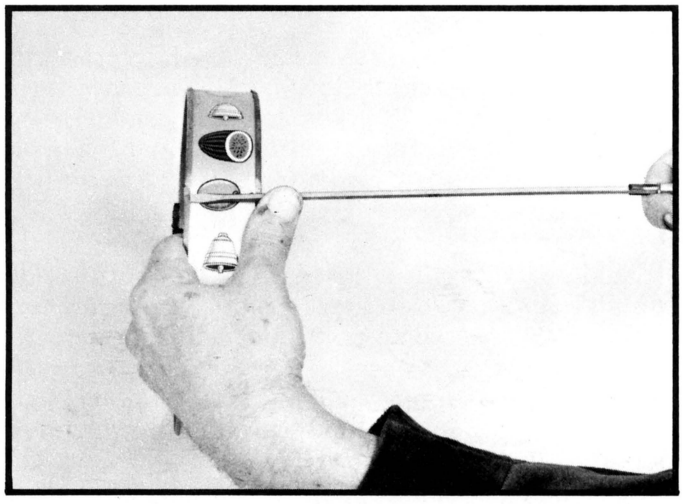


Figure 9.12

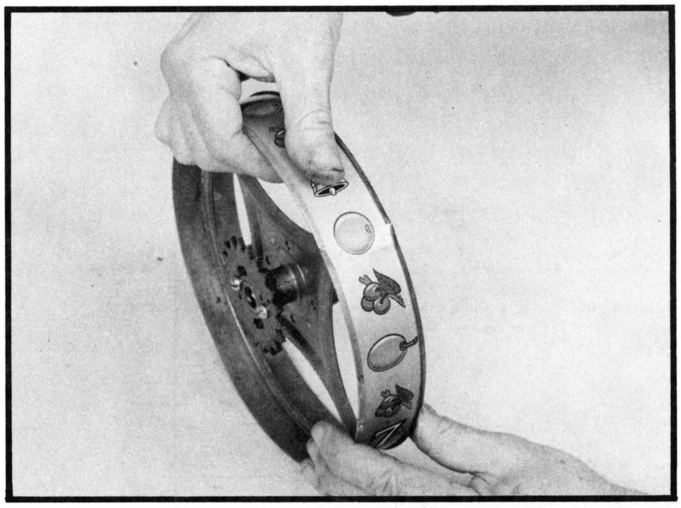


Figure 9.13

Figure 9.14

After all the crimps have been loosened, the paper is worked sideways in the reel channels until it can easily be moved in an unrestricted manner. This slight motion serves as a check to make certain that all of the crimps have been opened enough to allow easy transport of the paper in the reel channels.

Before sliding the reel paper out and away from the reels, it is necessary to pry open the two slits where the reel channels are formed on the reel. This is accomplished by prying one side of the channel up higher than the other side as shown in Figures 9.12 and 9.13 such that when the reel paper is rotated, it exits from the channel by going over one set of channels as it leaves the reel. Figure 9.14 shows the paper being extracted from the reel. The paper must be carefully moved in a circular manner, slowly, making certain that it is not being bound as it exits from the reel channels. The paper is continuously nudged in a circular motion until the entire reel strip has been removed.

The process of replacing the paper on the reel is simply the reverse of the above-outlined procedure. Start by manually feeding the end of the reel strip into

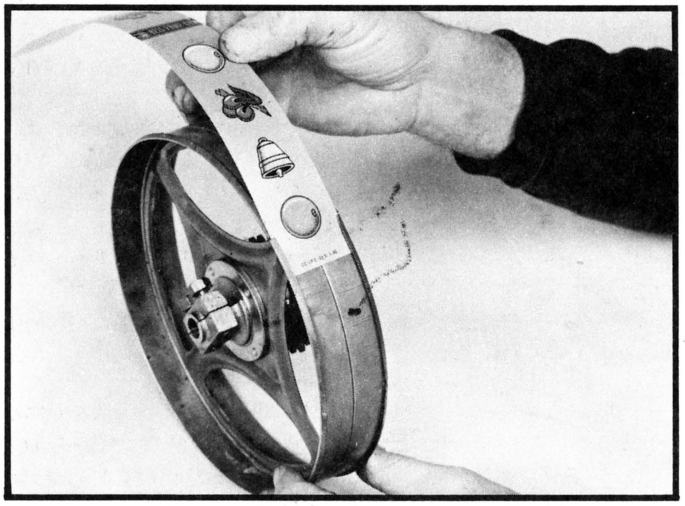


Figure 9.15

the reel where the opening in the channel exists as shown in Figure 9.15. The paper is continuously fed into the channel and around the reel until it is totally within the channel. Then, noticing where the mark was made at the beginning of the reel strip, the entire reel strip should be rotated such that the edge of the paper is again in line with the mark. By using a pair of diagonals, the crimps can be remade where they were, thus securely holding the paper in place. It should be noted that only a few crimps are needed to hold the paper in place, and normally crimps are only made where the reel paper overlaps itself and one place on the opposite side.

When inserting new reel paper onto the reel, there may be a discrepancy in the paper length and the paper should not be crimped yet, but the overlap line placed at the mark as a first start. The final crimping

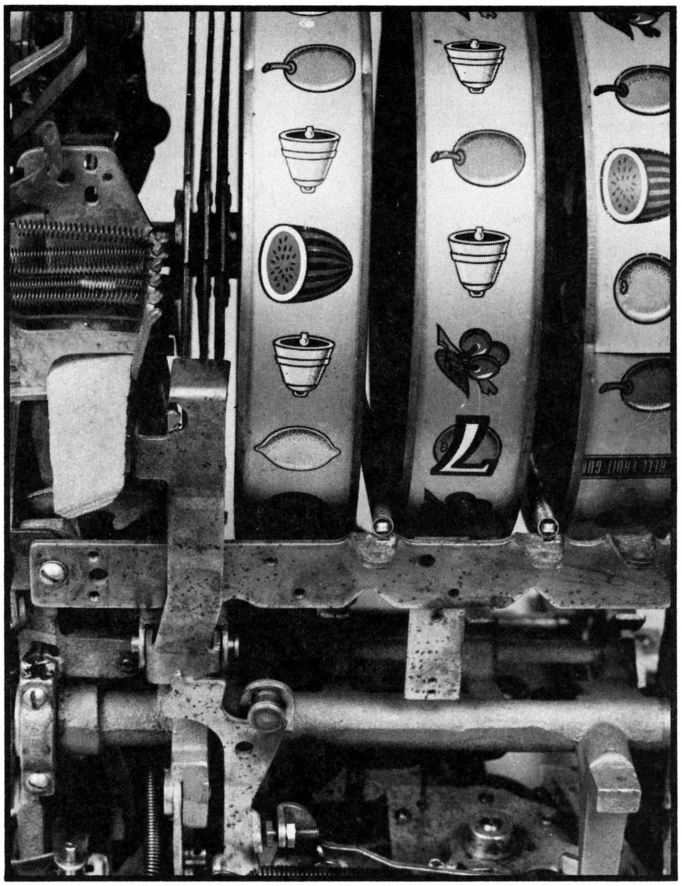


Figure 9.16

of the paper will be explained later in the chapter, when the reel assembly is inserted in the mechanism and the final alignment performed.

Alignment of the Reel Assembly

After the reel assembly has been reassembled with the reel strips, it is inserted into the mechanism, and the reel stop levers are connected.

There are several ways to align the reel strips and two methods will be given here. The first method is to use the jackpot bars as a guide, and the second method is to use the alignment holes on the reel discs (if they exist, shown in Figure 9.2).

Regardless of the method to be used, insert a thin strip of wood as shown in Figure 9.16 between the payout lever guide bracket and the payout levers themselves, so that they are held back and free from the discs. An alternate method to using the wood strip would be to remove the finger springs themselves, but some special provision still needs to be made for the jackpot lever since it is also spring loaded at the bottom. Once the reels are free to rotate, make sure that the mechanism completes its cycle with the reel strip levers engaging the starwheels.

Using the jackpot method, rotate the third reel until the jackpot bar appears on the payout line. It should be noted that the payout line is approximately at the top of the coin chute. Looking through the reel assembly, double check the position of the reel, by no-

ticing that the jackpot hole (the hole nearest the center of the shaft) is directly in front of where the jackpot payout lever would normally attempt to travel. It may be necessary to manually pull back the reel stop lever while rotating the reel to the desired position, but once in that position, the reel stop lever should be engaged firmly against the star wheel. This will be the reference position for the rest of the reels.

Next rotate the other two reels such that each of them produces a bar on the same horizontal line as the third reel. Notice that at this point the remaining two reel discs associated with the first and second reel are free to revolve, regardless of the position of their reels; it is the positioning of these two reel discs, before tightening the hub nuts on the reel assembly, that produces alignment.

Beginning with the reel disc associated with the first reel (the reel disc nearest the payout levers), rotate the reel disc while keeping the reel fixed until a jackpot hole appears opposite where the jackpot lever would normally travel. In this mechanism there are two bars on the first reel and thus there is ambiguity as to which jackpot hole is associated with which bar. This ambiguity is usually resolved by noting what the preceding and successive fruit are on the reel strip and by making certain that the reel disc has the corresponding holes on each side of the jackpot hole appearing in front of the payout lever. For example, on this reel strip, one of the bars is surrounded by a cherry and a plum while the other bar is surrounded by two plums. Thus, if the bar with two plums were showing on the payout line, the reel disc would be rotated such that the jackpot hole that had a plum hole on each side of it would be in line with the jackpot payout lever.

This procedure is repeated for the second reel and its reel disc such that all three jackpot holes are aligned and the jackpot lever can travel freely through all three reel disc holes. Before tightening the hub nuts on the reel assembly, it is necessary to do two final adjustments.

First line up the three saw teeth on the reel disc in a perfectly horizontal line. This will insure evenness when the kick arm engages them and provides uniform reel spin. The first and second reel discs are thus exactly lined up with the third reel disc. The hub nuts may now be tightened just snug—just enough to take out the slack.

In order to insure freedom of rotation of the reels between each other, a small gap of .005″ to .010″ (axial clearance) should be left between each of the hubs on the reels before the tightening is finalized. Now tighten the hub nuts completely. After the hubs have been tightened in this manner, the mechanism should be checked for different payout positions, to assure that no mistake has been made. Cycling the mechanism several times, smooth operation and spinning of all of the reels should take place. Specifically, cycle the mechanism once and while manually stopping the clock during the spinning, check to make certain that each reel spins smoothly and freely, independent of the other two reels.

On a machine where all new reel paper has been installed and it is desired to align the payout paper exactly, the above procedures are followed assuming that the paper has been approximately positioned. Now place the mechanism in the case, and while looking through the window, adjust the papers so the bars are exactly on the same line and in the center of the payout line. Remove the mechanism from the case and crimp the reel rims on the paper. This procedure will insure exact alignment of the paper as well as the reels themselves.

Alternate Reel Assembly Alignment

If the reel discs have the small alignment holes shown in Figure 9.2 then this alternate procedure may be used. The alignment holes are placed on the reel discs such that when they are aligned, the beginning of the reel strip paper is also aligned. Thus it is only necessary to align the three alignment holes and then rotate the reels such that the beginning of the reel strip paper on the three reels is also aligned. After aligning the beginning of the reel strips, simply tighten the hub nuts as previously described in this chapter.

Because of the 7-7-7 feature on this machine, the alignment procedure of the reel disc is somewhat simplified since it is only necessary to align the notch on the number one and two disc with the notch on the number three disc and then tighten, since there is only one notch per disc and therefore no possibility of ambiguity.

Adjusting Overly Long or Short Strips

Occasionally, when putting new paper strips onto reels, it is discovered that they are either slightly too long or too short. Here is a simple way to accomodate such strips.

The strip that is too long is the simplest to deal with. Cut a strip of thick, clean, white paper slightly more narrow than the reel strip itself — about ⅛″ is fine. Now place this false strip under the regular reel strip and check the alignment. If the strip is now too short, simply remove the false strip and cut some off. Cut the remaining false strip in half, and position one half on opposing sides of the reel. Replace the reel strip over the top and, again, check for length. If the reel strip is still too long, simply cut equal amounts off each piece of the false strip and replace. Eventually, by the "cut and try" method, you will adjust the circumference of the reel so that it will be just right for the reel strip.

If, on the other hand, the reel strip is too short, it can frequently be "stretched" by steaming and gently applying tension to both ends. This method must be used with caution; go easy, pull gently and take your time. The method *does* work—but *only* if you are pa-

tient. The impatient strip steamer is likely to end up with two short strips!

Ten-Stop Reels (pre-1932)

During the gooseneck era of Mills slot machines, (pre-1932), the reels were able to stop in only ten different positions. The reel paper, however, contained twenty symbols which meant that only every other symbol on the reels could appear on the payout line. Figure 9.17 shows a typical ten-stop reel assembly. Note how coarse the teeth are on the reel discs.

The analysis of the odds for the reel assemblies is completed the same as for the twenty-stop assemblies, except now there are only a thousand ($10 \times 10 \times 10 = 1{,}000$) possible combinations rather than the 8,000 available for a twenty-stop three-reel assembly.

Another feature often found on the ten-stop reel assemblies was a free play on the first reel, (usually superimposed on a lemon). This had the effect of mathematically making the first reel a nine-stop reel, thus making the total combinations $9 \times 10 \times 10 = 900$ or increasing the odds by 11%.

On many of the early 1920 machines, the reel symbols were made of tin and should be preserved if at all possible. It should further be emphasized that removal and care of these tin symbol strips is a very delicate job and their removal should be carefully approached only if absolutely necessary. Caution should be used when cleaning these tin strips. Products such as 409 and Fantastic can remove the paint from them. A mild soap solution and water, or even water alone, is best.

10 The Jackpot Assembly

General Description

The jackpot mechanism is located on the inside of the machine front as shown by Figure 10.1, Arrow A. It is supplied coins from the escalator when either the payout tube is overflowing or the coin tube shutoff lever has been activated. The coins enter the jackpot mechanism via the jackpot loading chute, shown by Arrow B. After the jackpot has been sufficiently loaded with coins, the overflow coins are then routed to the cashbox at the lower right-hand side of the mechanism as indicated by Arrow C. When a jackpot combination occurs, the coins in the jackpot are released and once again coins coming from the jackpot loading chute begin to fill the jackpot mechanism.

The jackpot mechanism shown in this machine is referred to as a "self-loading" jackpot, since the mechanism automatically replenishes itself with coins. Another type of jackpot commonly used in clubs is the "front loading" jackpot in which the coins are manually inserted through the front of the mechanism via a locked door. When a front loading jackpot is used, the coins coming from the jackpot leading chute are always routed directly to the cashbox.

It should be noted, that because the jackpot is hidden and tucked away it is a relatively difficult piece of equipment to maintain, and consequently it is very common for jackpot assemblies to be malfunctioning simply because of lack of maintenance or ability to service it.

The jackpot assembly on the gooseneck-style machine is covered in Appendix D.

Jackpot Assembly Removal

The jackpot assembly is held in place by three shoulder screws. One screw is located at the top of the jackpot assembly and the other two are at the bottom, one on each side. The machine case should be laid face down on a padded working surface before the screws are removed.

First remove the screw holding the jackpot loading chute as shown in Figure 10.2. Then remove the jackpot shoulder screw located at the lower right-hand side of the jackpot as shown in Figure 10.3 and the

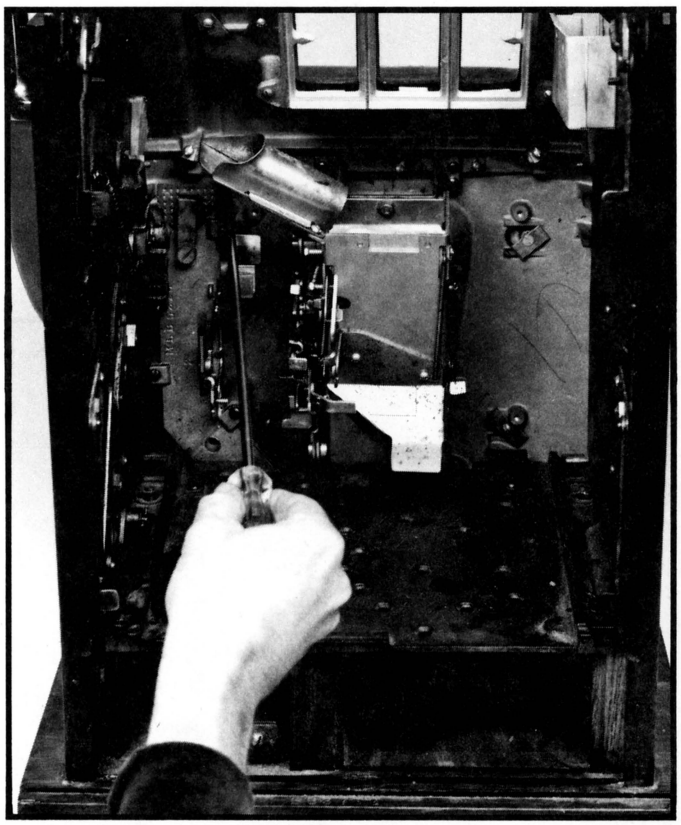


Figure 10.2

one on the left bottom side as shown in Figure 10.4. This screw is barely accessible and requires a long screw driver (at least 11″ in length) and a lot of patience. Next remove the screw located at the top center of the jackpot as shown in Figure 10.5, and remove the jackpot assembly. Finally remove the jackpot glass and the glass spacer as shown in Figure 10.6 and 10.7. Note the relative position of the glass and glass spacer when removing them so they can be replaced in their proper order.

An alternate method of removing the jackpot assembly is to remove the top front of the case and then the entire bottom front of the case, thus providing easy access to the jackpot assembly. This technique is especially recommended when the case must be disas-

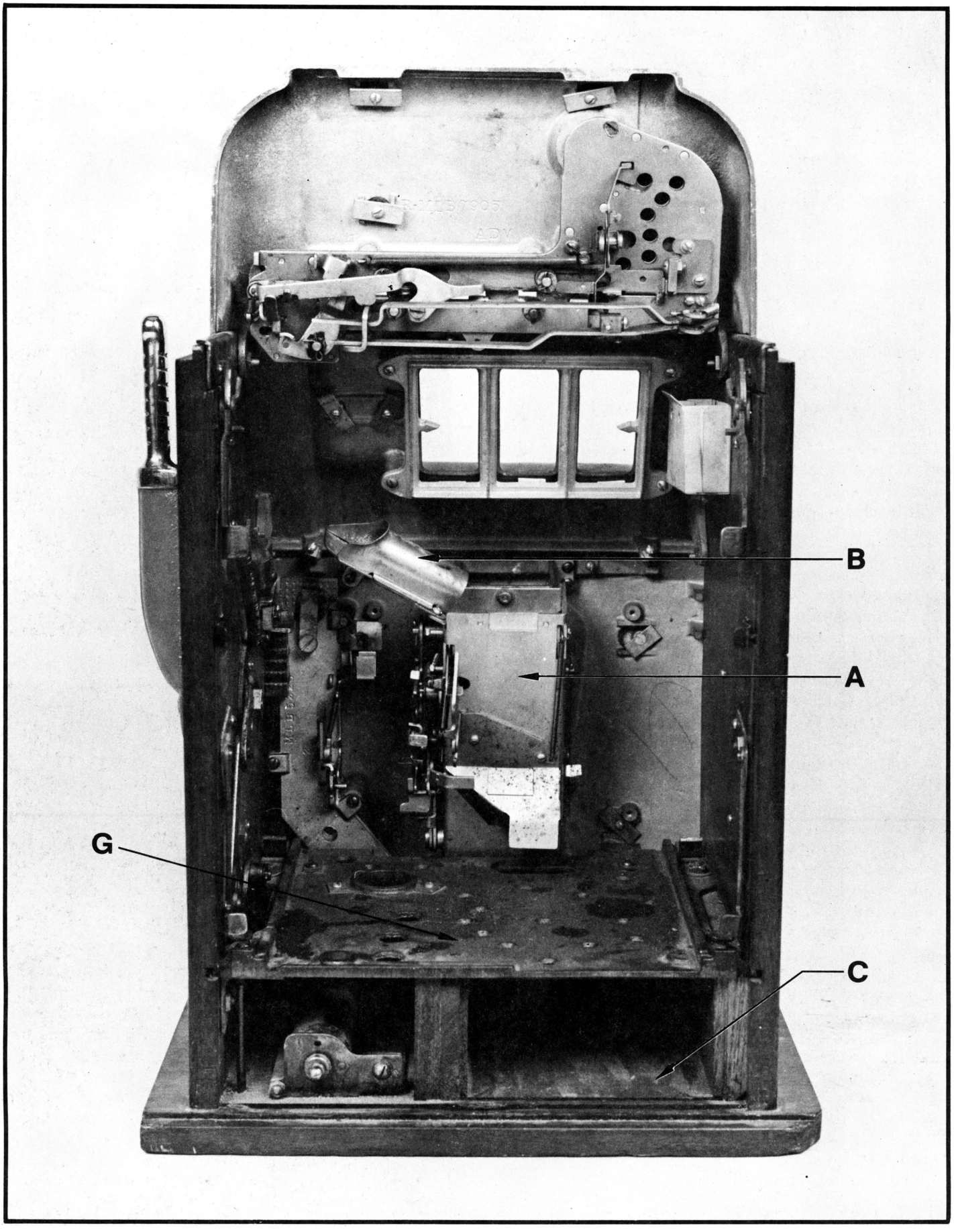


Figure 10.1

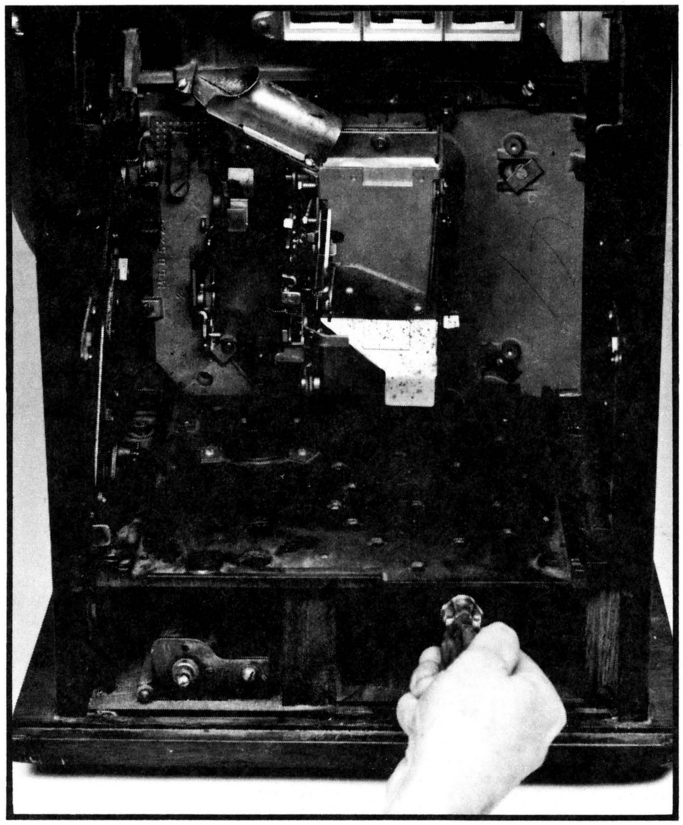


Figure 10.3

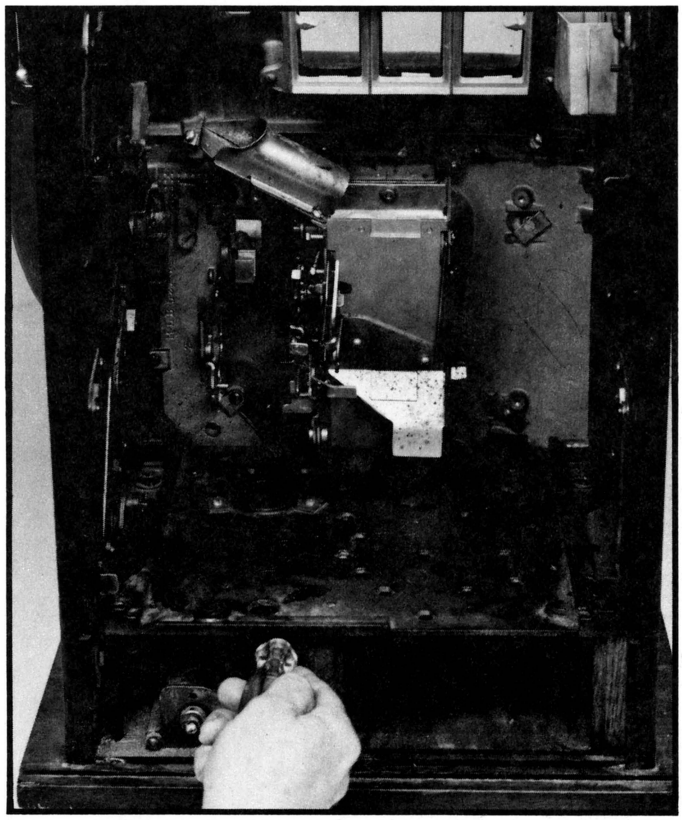


Figure 10.4

sembled for refinishing purposes.

The General Theory of Operation

Figure 10.8 shows the combination front and side view of the jackpot assembly. Coins enter into the jackpot as shown by Arrow A; and fill the reserve jackpot, indicated by Arrow B; and the main jackpot,

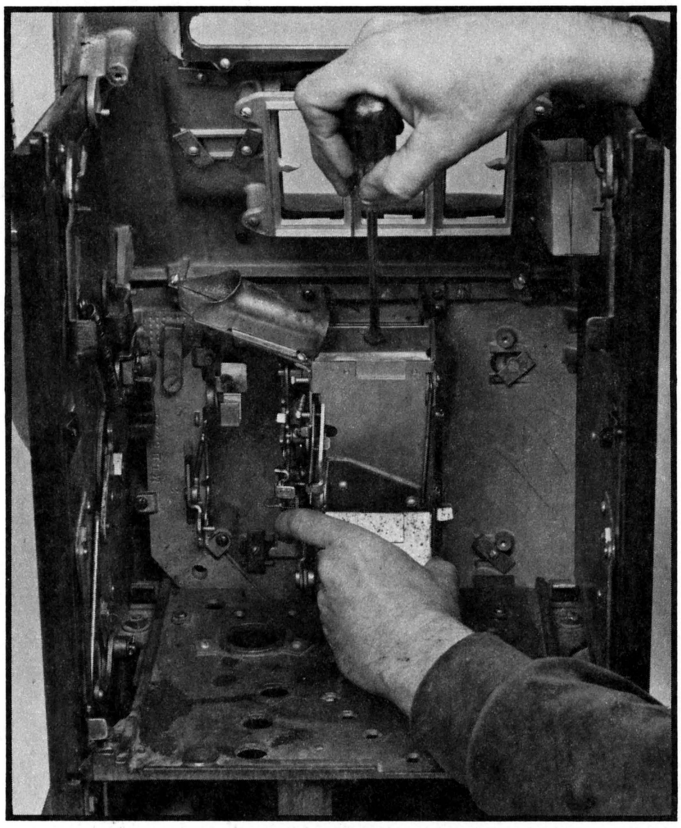


Figure 10.5

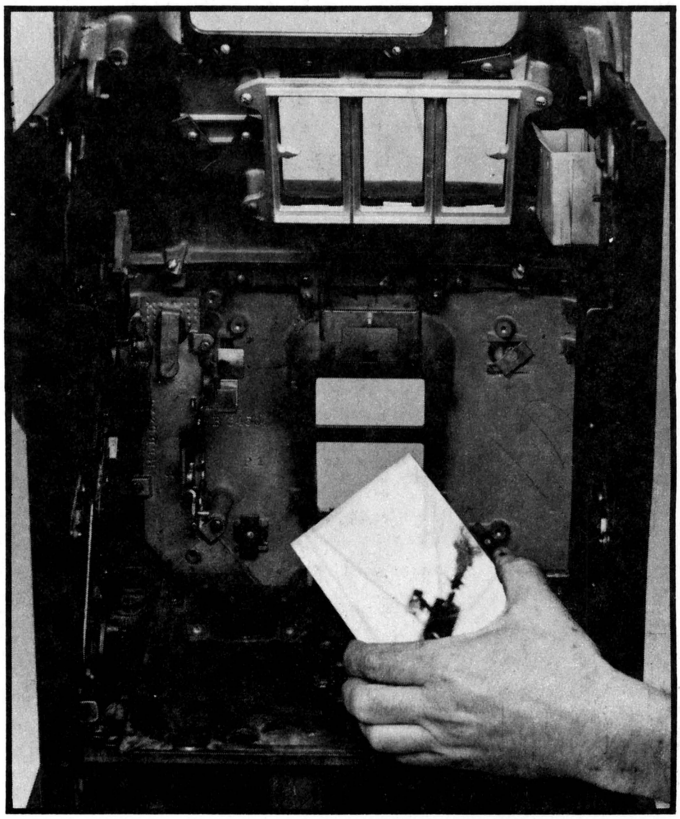


Figure 10.6

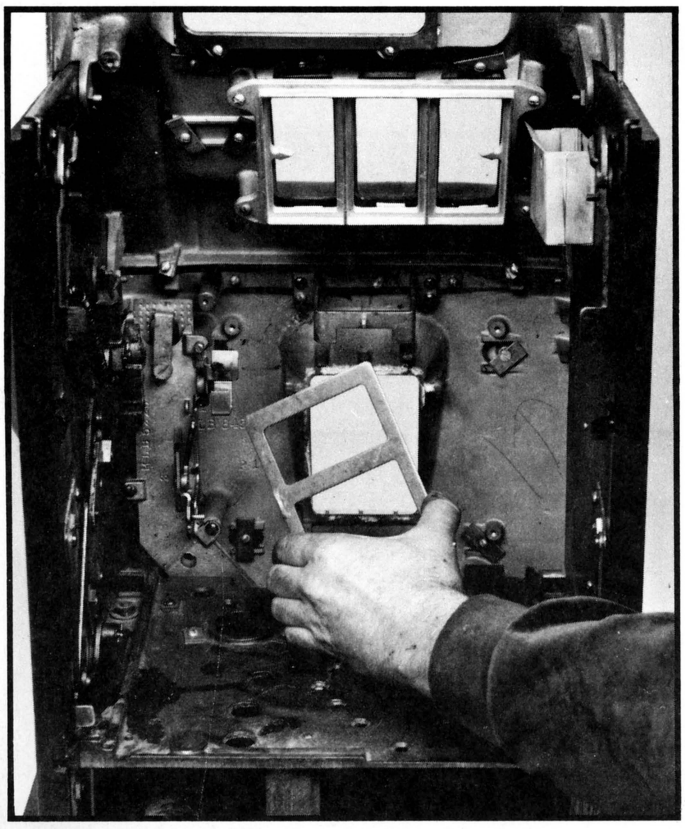


Figure 10.7

indicated by Arrow C. When both of these jackpots are filled, then the overflow coins pass through the jackpot, out the rear and into the cashbox shown by Arrow D. When a jackpot occurs, the coins are released by the jackpot and exit through the front portion of the jackpot, indicated by Arrow E. On the next play of the machine the main jackpot door closes, and then the reserve jackpot door opens dropping the coins it holds into the main jackpot. This gives the jackpot, which is displayed in the front of the mechanism, a "headstart" in filling up and adds to the attractiveness of the jackpot temptation. On the next play of the machine (the second play from the time the jackpot was hit) the reserve jackpot is again closed and can again commence to store coins.

The next two sections of this chapter will be concerned with explaining in detail the operation of the jackpot while it is being filled with coins and while it is dropping the coins.

The Filling Cycles of the Jackpot

Undertanding how the jackpot is filled can best be explained by referring to the cross-section illustration, Figure 10.9. The coins enter the jackpot mechanism via the coin loading chute and drop onto the spring loaded reserve deflection plate as shown by Arrow A. Some coins will then deflect into the reserve jackpot shown by Arrow B and some will continue downward. When the reserve jackpot is full, all additional coins will continue downward, since when there is no room left in the reserve jackpot, coins which pass the reserve jackpot will deflect against the spring loaded main jackpot deflection plate, indicated by Arrow C. If the jackpot is not filled, the coins will be deflected into the jackpot, indicated by Arrow D. When this jackpot has been filled with coins, it too will overflow, and the overflowing coins will force the jackpot deflection plate to open, allowing subsequent coins to pass all the way through into the cashbox through the back chute as shown by Arrow E.

If the jackpot is to be filled manually (referring to Figure 10.9), the reserve deflection plate is depressed downward, shown by Arrow A, and the main jackpot deflection plate, shown by Arrow C, is held up and all coins entering the jackpot will then be routed directly into the main jackpot as indicated by Arrow D. This manual loading is easily accomplished when the operating mechanism has been removed from the case and direct access to the jackpot is available. Much of the sophistication of the "automatic loading" jackpot is

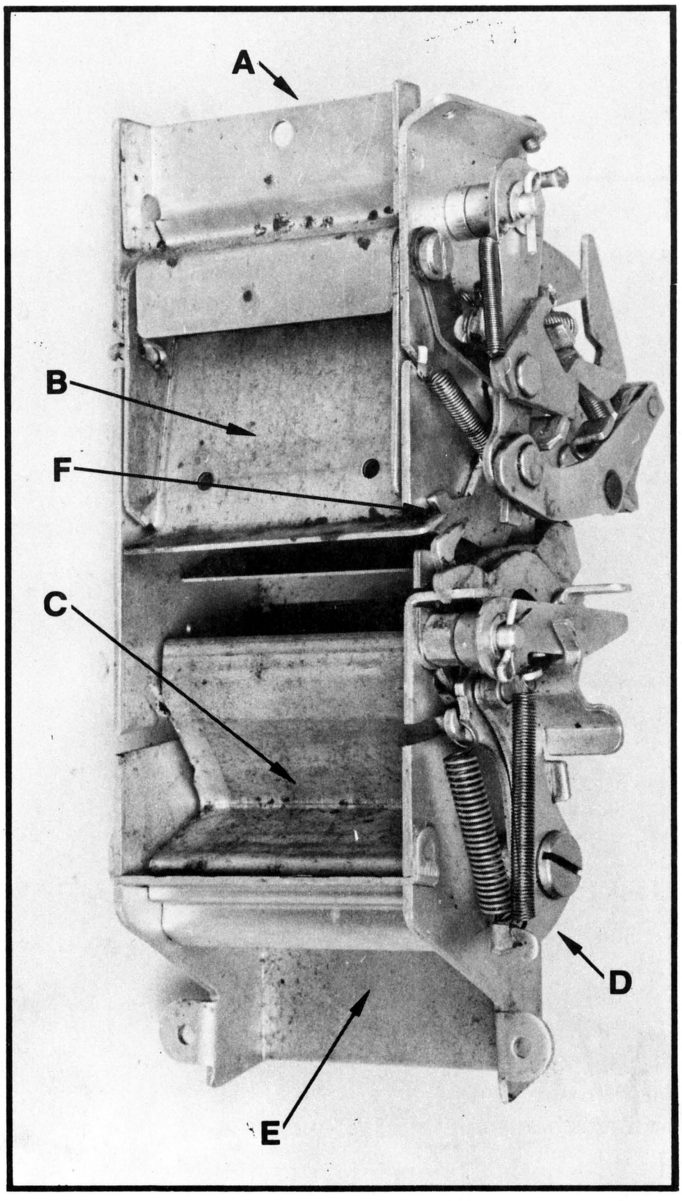


Figure 10.8

not necessary for home use since the manual option is readily avaiable.

Figure 10.10 shows the rear view of the jackpot assembly and is used here to identify the specific levers which control the two deflection plates mentioned in the preceding paragraphs. Arrow A points to the lever which is physically connected to the reserve deflection plate, and is free to move at any time. Arrow B points to the lever which is physically connected to the main jackpot deflection plate. As can be seen, lever B is restricted by an additional lever. In order to freely operate this lever it is necessary to pull away the constraining lever before it can be moved. By pushing up on lever A and moving lever B downward, the desired configuration of the deflection plates is achieved

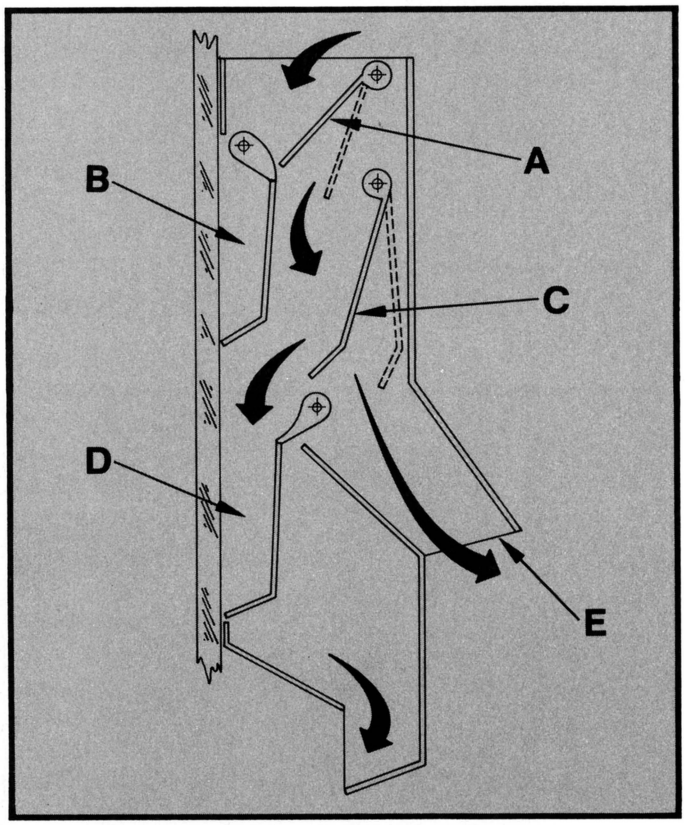


Figure 10.9

to fill the main jackpot. To fill the reserve jackpot, it is only necessary to hold lever A down while filling the jackpot with coins.

Jackpot Dumping

The sequences of operations which are executed when a jackpot occurs is explained by referring to Figure 10.8. On the play of the mechanism when the jackpot is achieved, the jackpot door behind, shown by Arrow C, swings open allowing the coins accumulated behind it to fall through the bottom of the jackpot mechanism, Arrow E which leads to the jackpot payout tray. On the next play of the mechanism the jackpot door, indicated by Arrow C, closes and immediately afterwards the reserve jackpot doors open,

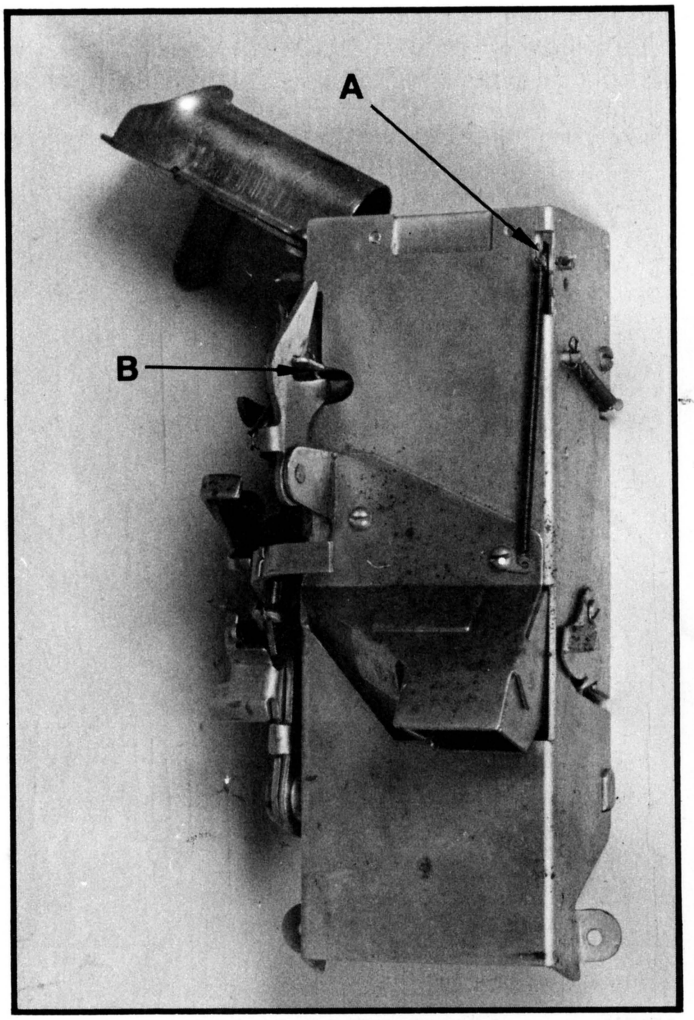


Figure 10.10

Arrow B, allowing the coins to fall directly downward and thus into the main jackpot compartment. The reserve jackpot door is left open until the next succeeding play at which time it is closed leaving the jackpot mechanism in its ready position. It is the function of the levers and latches on the right-hand side of the jackpot to control the above sequence of events.

Operation of the Jackpot by the Operating Mechanism

If the only function of the jackpot was to open and close the main jackpot door, then most of the levers could be eliminated from the jackpot mechanism. It is the addition of the reserve jackpot that greatly complicates the structure of this mechanism. Figure 10.11 shows the index finger pointing toward the jackpot dump assembly lever. When this lever is pushed forward by either the payout slide or the jackpot push-bar, it cocks the jackpot door in the closed position. The jackpot trip lever shown by the screwdriver is the locking mechanism for the jackpot, and when it is lifted up it releases the jackpot dump lever, thereby allowing it to swing open. This simple sequence of events is totally self-sufficient for the main jackpot operation, but because of the reserve jackpot, all of

the additional linkage is required.

When the mechanism is installed in the cabinet, the jackpot pushbar, which is attached to the main oper-

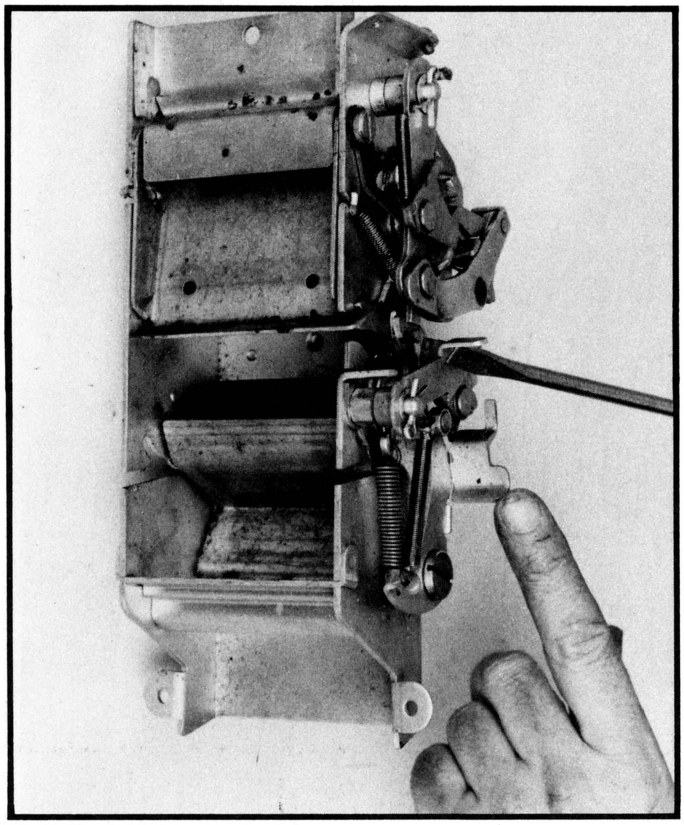


Figure 10.11

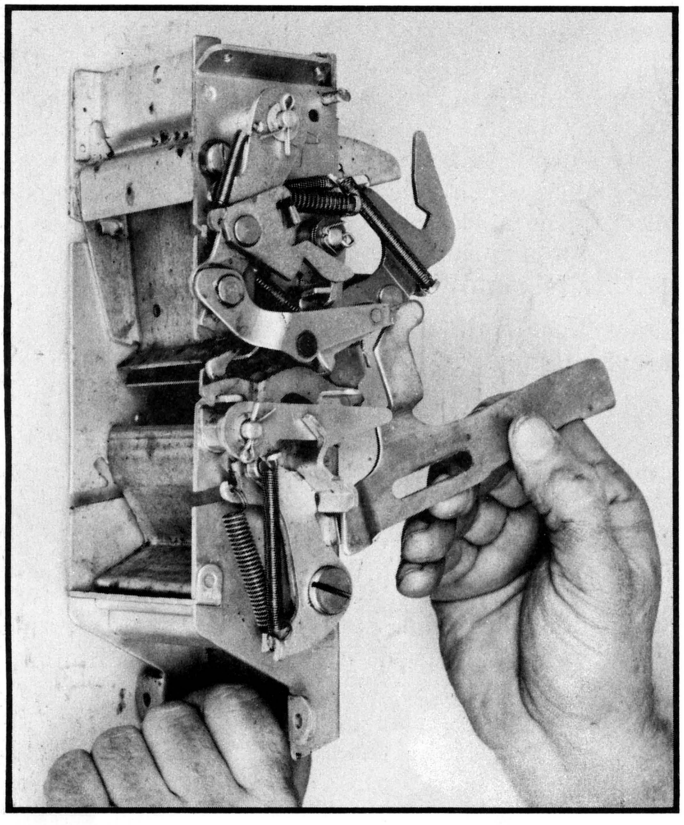


Figure 10.12

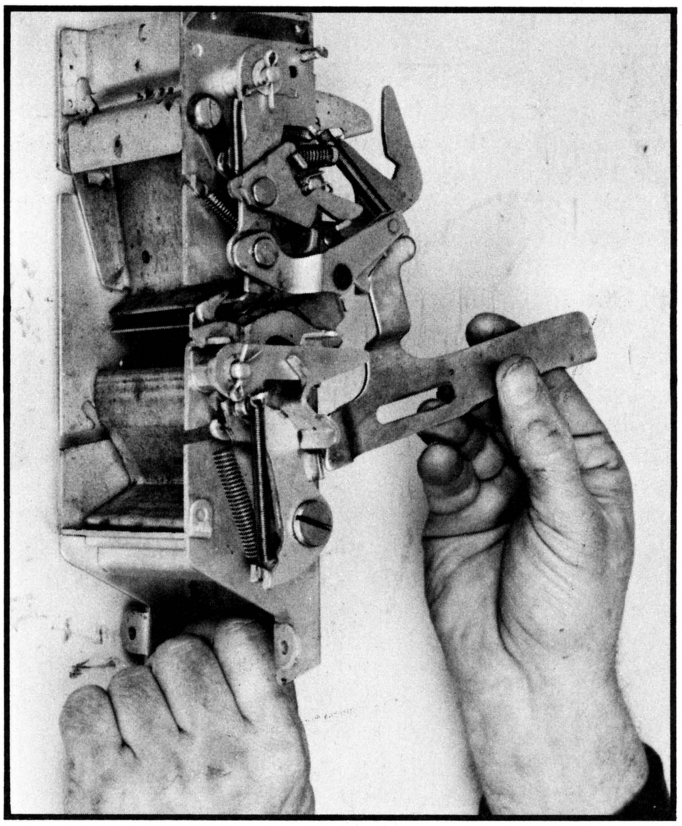


Figure 10.13

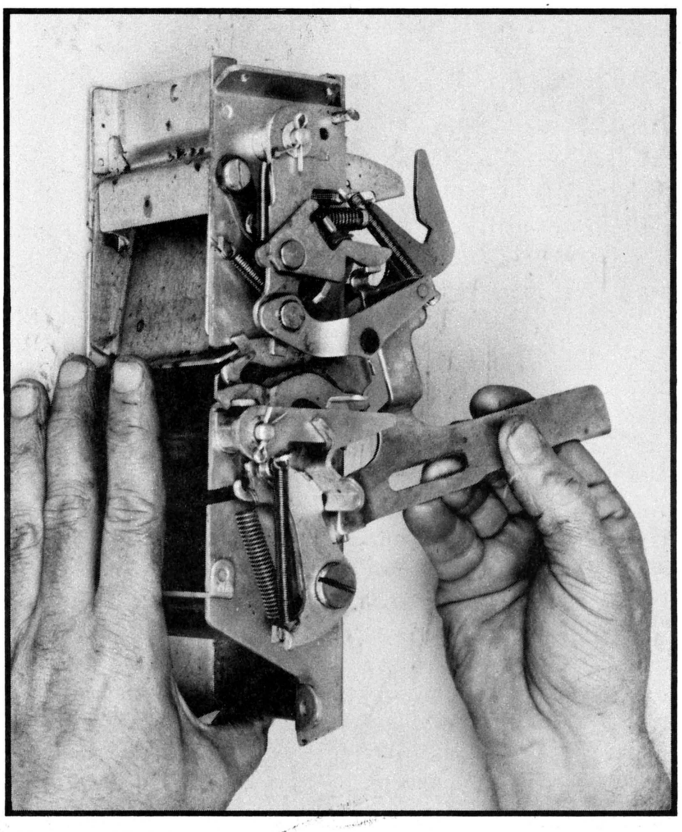


Figure 10.14

ating mechanism, moves back and forth one inch on each cycle of the machine, and it is the interaction of this bar with the jackpot that causes the sequencing

required by the jackpot. Figures 10.12, 10.13 and 10.14 show the relative position of the jackpot pushbar with the jackpot during cycles of operation. When a jackpot occurs, the top payout slide on the mechanism will actuate the jackpot trip lever and raise it upwards against the jackpot locking lever, thereby tripping the dump lever. On the next stroke of the jackpot pushbar (corresponding to the next machine cycle), the upper reserve jackpot is closed thus completing the jackpot cycle.

Needless to say, there is a large amount of complexity to preserve the operating reserve jackpot feature. It is explained here for completeness and is not necessarily a desirable feature to have since the jamming of the reserve jackpot mechanism can lead to total malfunction of the jackpot itself. Moreover, it is not uncommon for machines to have the jackpot pushbar missing on the mechanism, in which case it is totally impossible to sequence the reserve jackpot and the slot machine relies entirely on the forward motion of the payout slides to reset the jackpot dump lever.

Appendix B shows a different type of jackpot commonly used in many of the older Mills machines. The basic difference in this type of jackpot is the method in which the jackpot is tripped. While the overall function is identical and most of the parts the same, the technique is different enough to warrant special treatment.

Overhaul and Cleaning of the Jackpot Assembly

The number one cause for jackpot malfunction is dirt or dried and gummy grease. The second cause is missing, broken or over-stretched springs. If the jackpot assembly has been removed from the case, it is strongly recommended that a few minutes be spent to clean and oil the assembly. The simplest way to clean the jackpot is to disassemble the lever assemblies by removing their respective shoulder screws and cotter pins. Figures 10.15 through 10.22 show the step by step disassembly of the operating levers of the jackpot. First remove the cotter pin which holds the reserve operating lever assembly to the jackpot and pull the assembly away as shown in Figures 10.15 and 10.16, detatching the extension spring from the mechanism. Next, remove the jackpot locking lever assembly, as shown in Figures 10.17 and 10.18, by removing its cotter pin and carefully unhooking its extension spring from the jackpot dump lever assembly below. Then remove the jackpot dump lever assembly by unscrewing its shoulder screw as illustrated in Figures 10.19 and 10.20. Finally, remove the reserve retainer locking lever assembly, as shown in Figures 10.21 and 10.22, by removing the cotter pin and disconnecting the extension spring. After the jackpot assembly has been disassembled to the state shown in Figure 10.22 and thoroughly cleaned with solvent, the four hinged plates should be *very lightly* oiled at their pivot points. The lever assemblies should be thoroughly cleaned with solvent, and light machine oil should be sparingly applied to all of the main working parts and

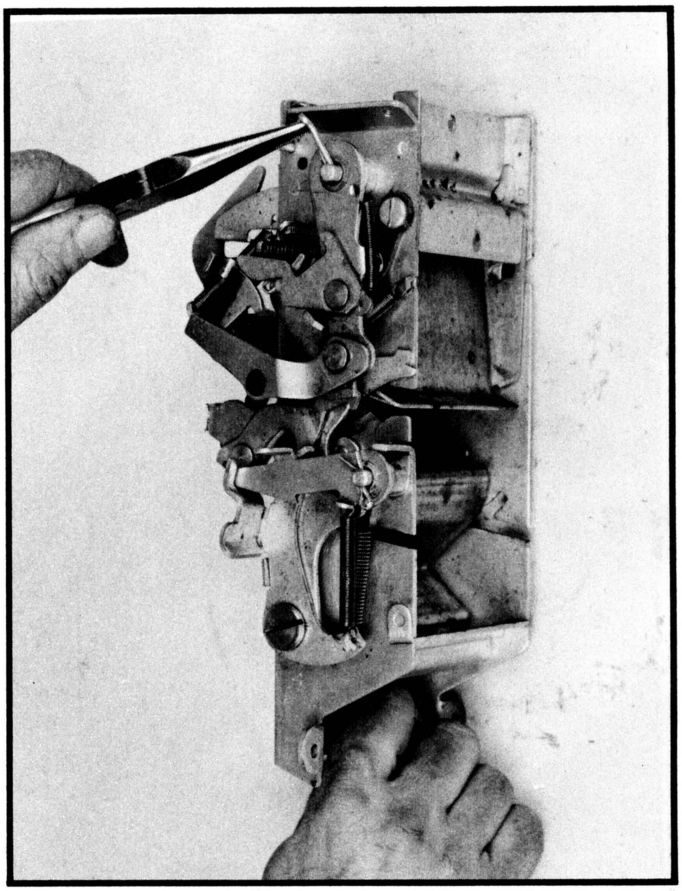


Figure 10.15

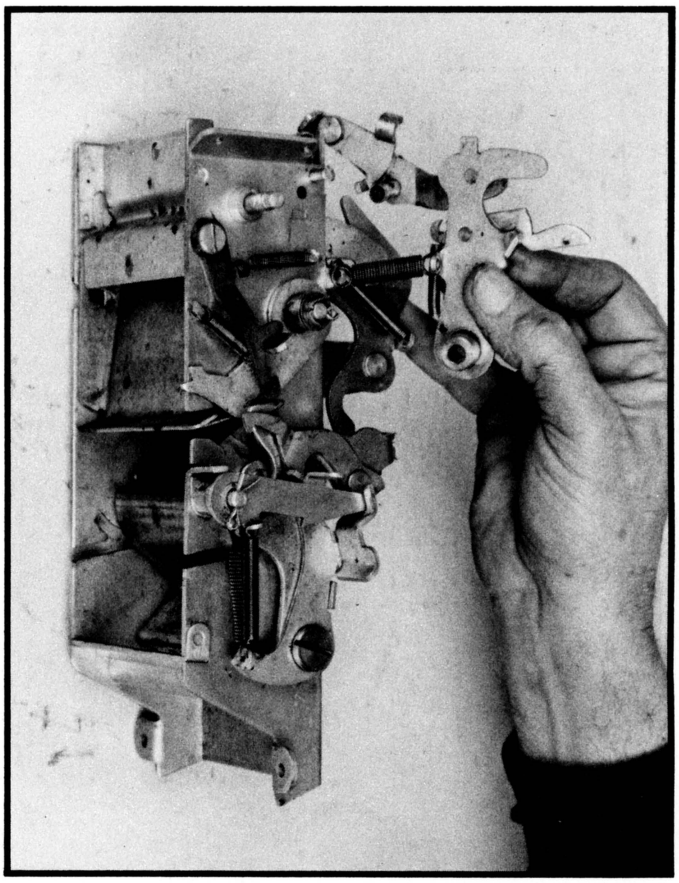


Figure 10.16

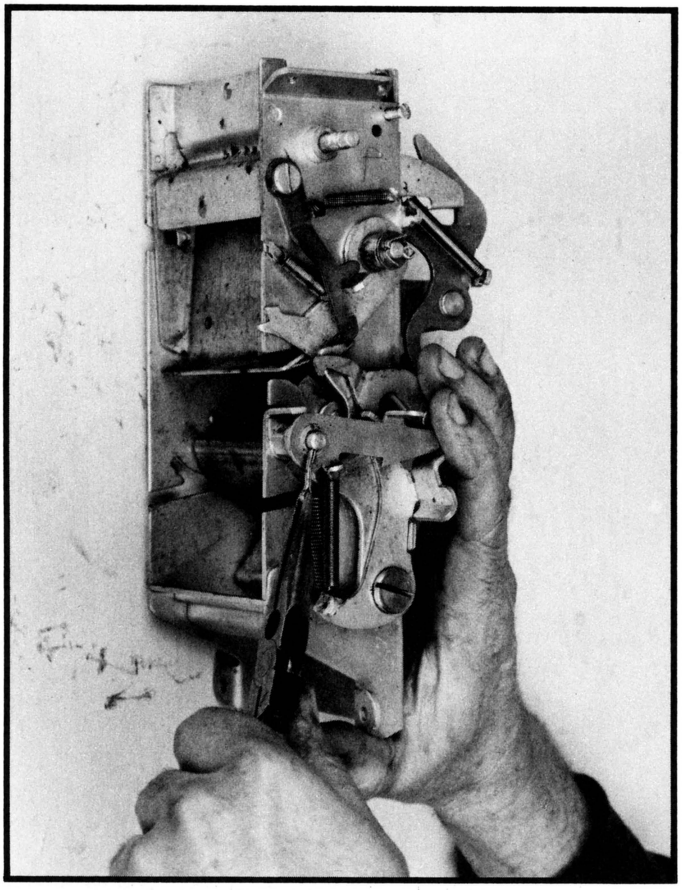


Figure 10.17

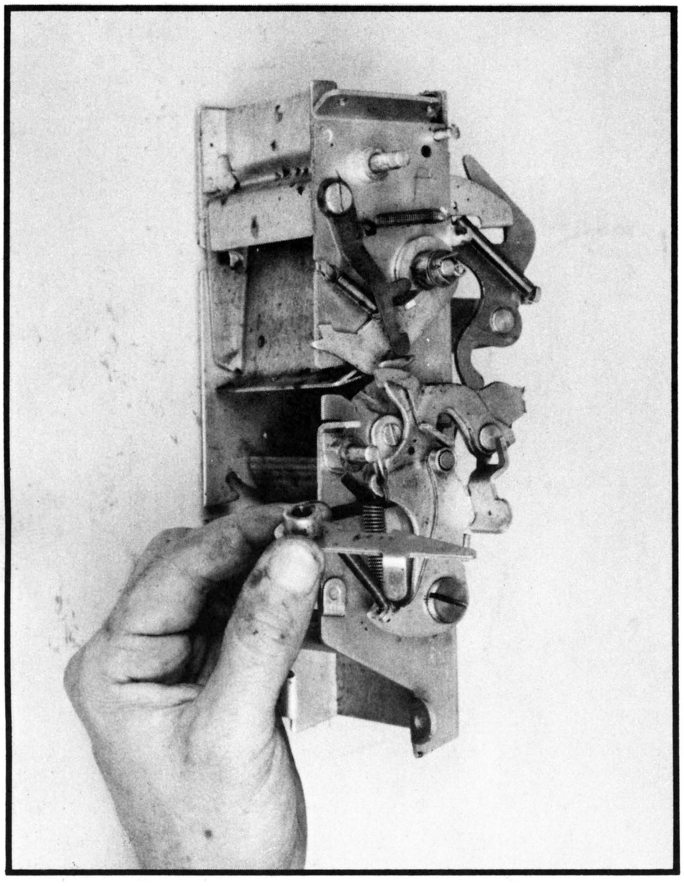


Figure 10.18

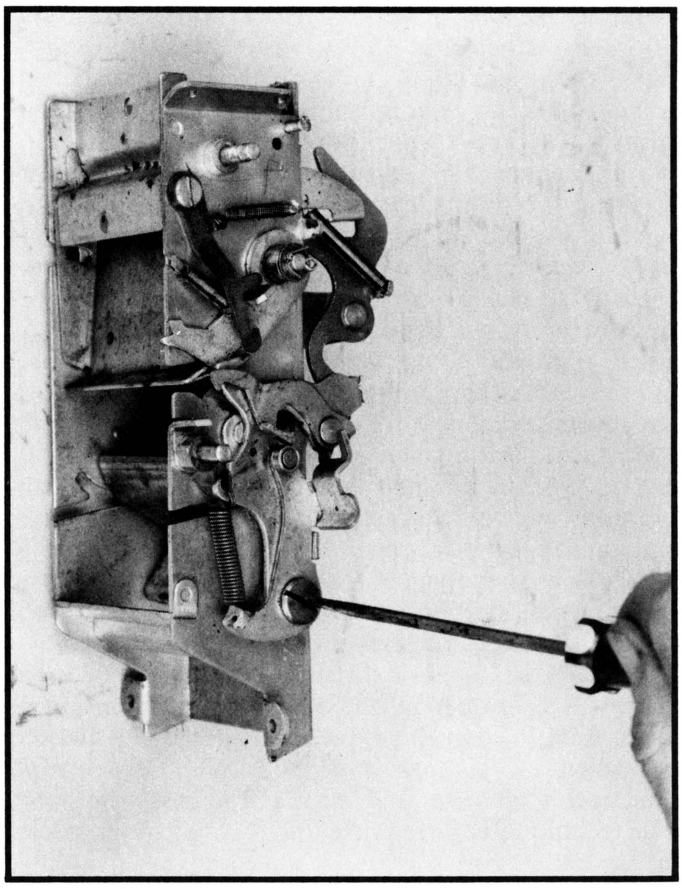


Figure 10.19

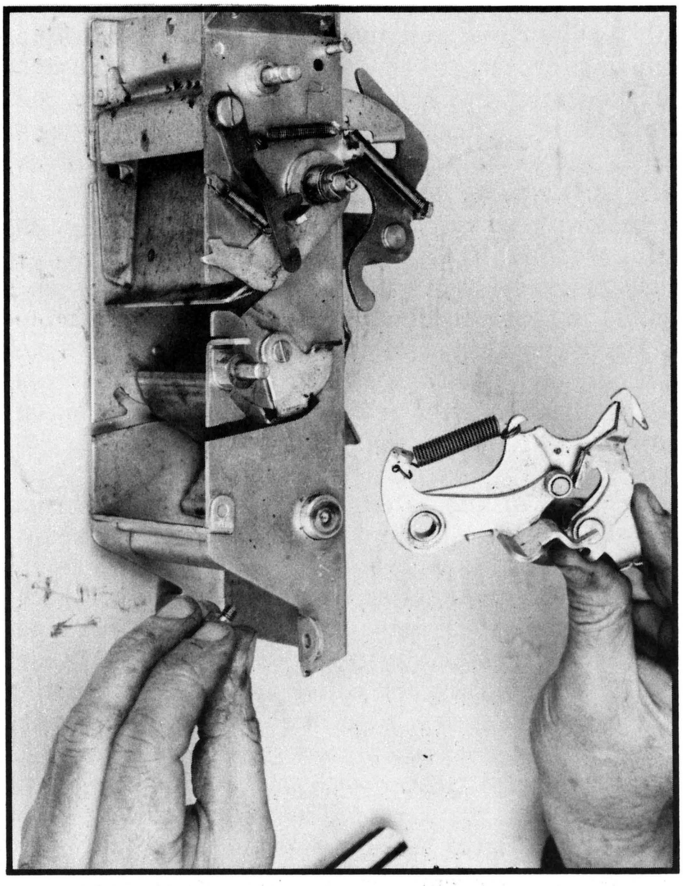


Figure 10.20

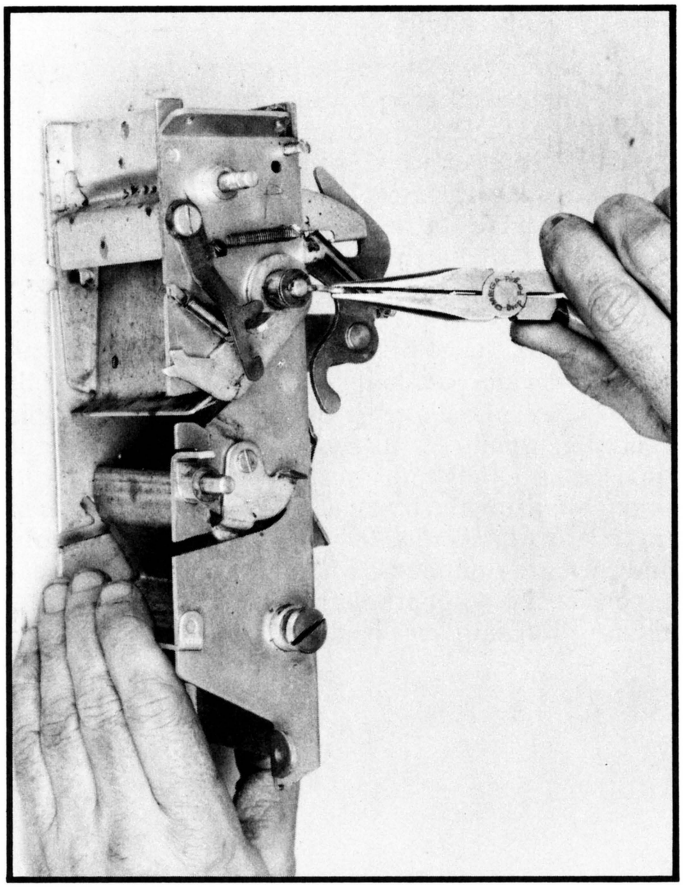


Figure 10.21

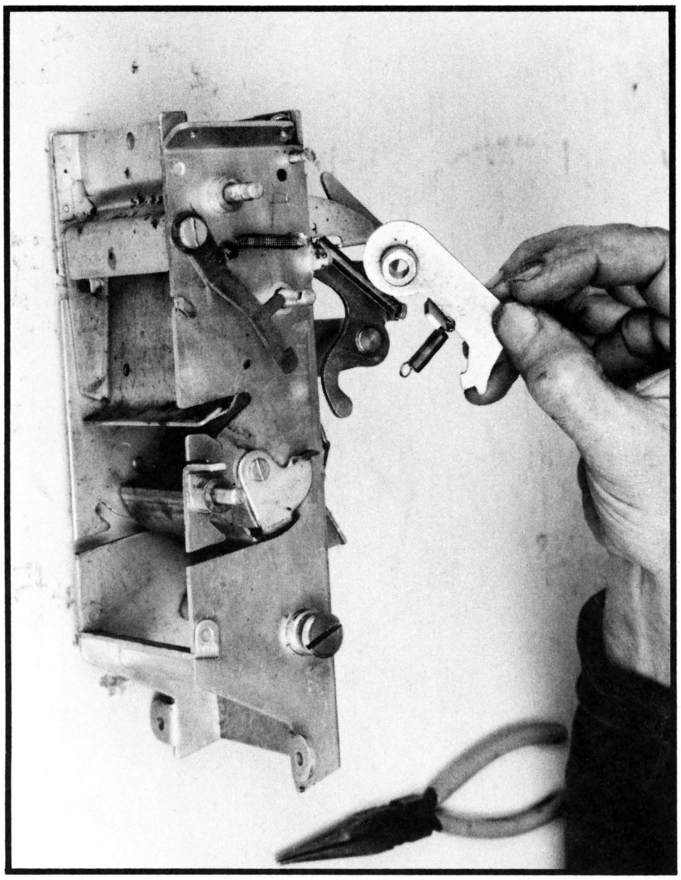


Figure 10.22

bearings before reassembly.

The assembly of the jackpot is accomplished by reversing steps 10.15 through 10.22 and is a straight forward operation. After the jackpot has been assembled, it should be manually cycled by hand several times to assure proper operation and smooth working of the parts.

While the reserve feature of the jackpot adds quite a bit of complication, there is one strong feature to be said in its favor. If the machine in which this jackpot is used has a window aperture where both the reserve and the main jackpot can be seen, it is very interesting to watch the cycling of the two jackpots when the main jackpot has been achieved. This action is usually demonstrated manually by the enthusiastic collector since the probability of getting the jackpot is so small. Demonstrating the operation of the jackpot is also a good way to keep it in working condition.

Installing the Jackpot into the Case

Installation of the jackpot in the case is relatively straight forward with two major exceptions. First, the metal spacer is placed in the case exactly as it came out, and then the jackpot glass placed on top of it. It is now very important to make certain that the reserve jackpot door is positioned with respect to its holding notch, exactly as shown in Figure 10.8 as indicated by Arrow F. Any other positioning of this lever and the door before assembly will cause malfunctioning of the reserve system and the jackpot. The easiest way to install this jackpot is to hold the lever and door with one hand exactly in the position while laying the jackpot on the face of the glass angled such that the other side is touching the glass, and then slowly rotate the rest of the jackpot flush with the glass while preserving this position. Once the glass is across the face of the jackpot, then it is impossible for the door and the lever to change positions adversely.

The jackpot shoulder screws are now inserted and used for securing the jackpot to the case. As mentioned previously, the shoulder screw located on the lower left-hand side of the jackpot is extremely difficult to insert and it is almost necessary to use a long screwdriver with a self-holding latch on the end of it to get this screw started. If the jackpot has been removed by previously removing the front casting from the case, then the installation of the jackpot presents no problem.

A final word of caution on tightening the three jackpot screws holding the jackpot to the case. It is the intent to have the jackpot firm but not tight against the glass, and if the proper spacing and glass thickness have been preserved, then there should be a small cushion due to the felt pads on the jackpot shoulder screws which apply the required pressure. It is quite easy to crack the jackpot glass or at least chip it by over tightening the jackpot shoulder screws if the correct tolerances are not maintained.

After the jackpot has been installed in the case, it is a good idea to cycle the jackpot manually. This is

done by manually pushing the jackpot dump lever forward until it cocks and then manually tripping the trip lever while observing the jackpot door.

To check the reserve feature of the jackpot, the mechanism must be inserted into the case and the jackpot set manually and cycled as mentioned. If it appears to be malfunctioning, there are two ways to locate and correct the problem.

One method is to remove the top half front of the case and then look down into the mechanism as it is cycling and observe the interaction between the jackpot assembly and the operating mechanism. Removal of the top half of the case is relatively simple and requires the removal of the four carriage bolts holding the top half of the front to the case.

The other method requires the removal of the reel assembly. After the reel assembly has been removed and the mechanism placed into the case, there is usally adequate room in which to inspect and repair the malfunction.

Jackpot Adjustment

There are two common adjustments made on the jackpot to provide proper operation. The first is to assure that the jackpot trip lever on the operating mechanism is being pushed sufficiently to trigger the dumping of the jackpot. The trip lever can be bent in order to achieve the desired result.

The second adjustment involves the movement of the base plate in the case as shown by Figure 10.1, Arrow G. Moving this plate forward or backward determines the throw of the jackpot pushbar with respect to the jackpot. It is common to see the jackpot not being recocked after it has been emptied, and this condition usually results because the pushbar has not traveled far enough forward. A word of caution is in order; adjusting the base plate also causes a change in the relative interaction of the operating mechanism and the escalator. Thus, when moving the base plate to remedy a jackpot problem, make certain that an escalator problem is not being created.

11 The Escalator Assembly

Introduction

The escalator is located in the top portion of the case above the reel window. Its basic function is to accept a coin, and having determined it is a valid coin, to allow the mechanism to cycle once, thereby allowing one play per coin. In order to understand the operation of the escalator, it is easiest to break down its operational cycle into three phases which are called the coin accept and detect phase, the coin advance phase and the rest phase. Each of these phases will be described with the particular functions they perform and the necessary mechanical operations associated with them.

The gooseneck assembly is covered in Appendix C; it is the pre-1932 forerunner of the escalator.

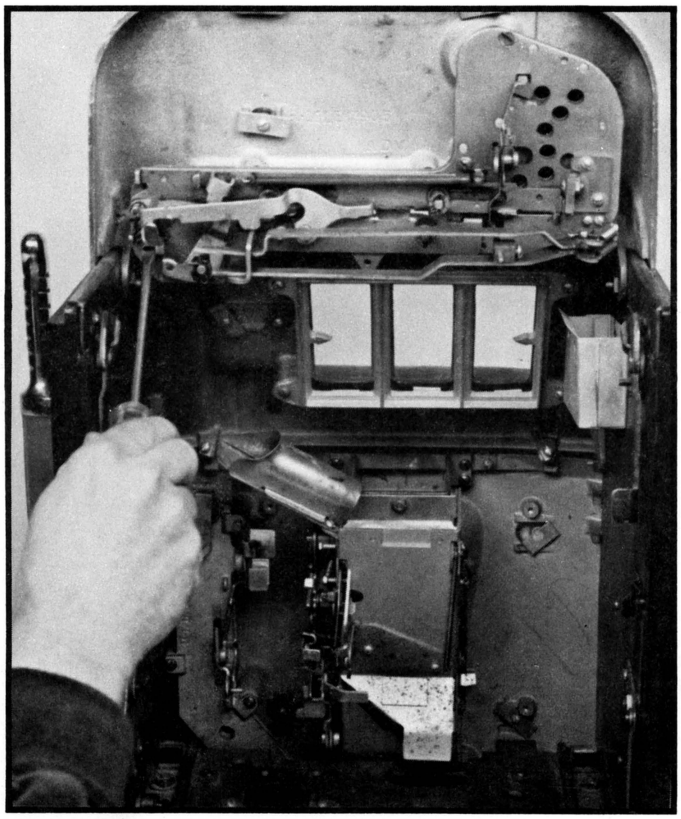


Figure 11.1

Removal of the Escalator from the Case

There are three screws holding the escalator to the case. Traditionally these screws have been painted red and are referred to as the "red screws" in most operator's manuals. The first of these screws is loosened as shown in Figure 11.1. The second screw, which is located at the bend of the escalator approximately eight inches over from the first screw, is then removed. Finally the third screw is removed, while holding the escalator with one hand and unscrewing it with the other as shown in Figure 11.2. Note that this third screw is a flathead screw, fitting into a countersunk hole.

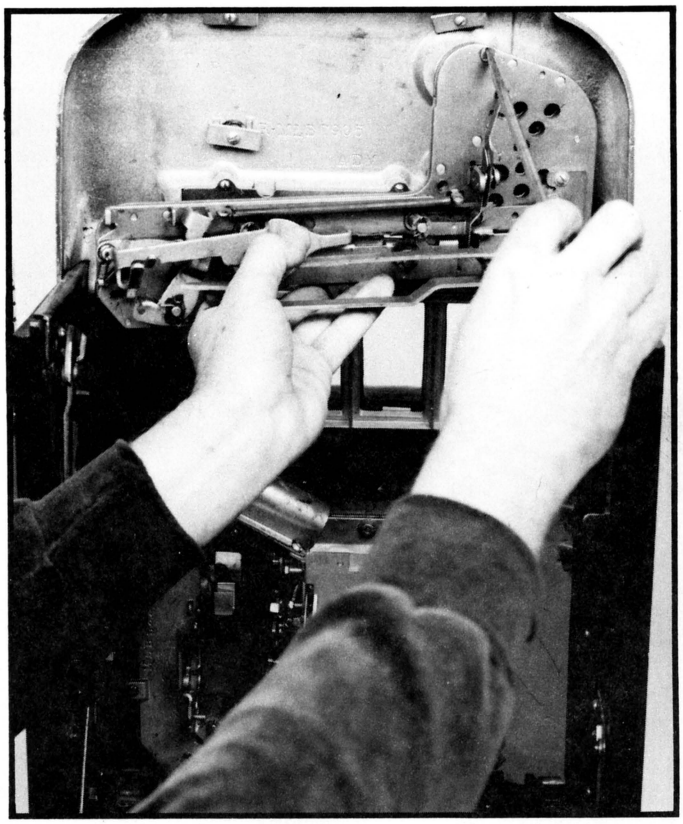


Figure 11.2

It is a relatively simple task to remove and replace

the escalator from the case. When coin jams occur in the escalator (the number one malfunctioning problem of a slot machine) the easiest way to unjam the escalator is to first remove it from the case and then eliminate the problem rather than trying to use an ice pick or screwdriver from behind while still in the case. Moreover, it is not recommended to unjam the escalator using metalic picks, since they can easily cause scratching of the channels in which the coins travel; their use can aggravate the problem in the long run.

The Accept and Detect Phase

A coin or check (token or gaming trade checks are the size of a coin with a hole in the center) of the correct size or smaller is inserted into the entry hole, Figure 11.3, Arrow A. The coin then rolls down the path in the escalator by gravity and past the magnet assembly, Figure 11.3, Arrow B, which is adjusted to allow the correct size of a non-ferrous coin to pass. If a ferrous coin (slug containing iron) is present, it will be diverted to a different path and exit on the far left side of the escalator as shown be Arrow C in Figure 11.3. If the coin passes the magnet, it continues on the intended path and lands in the detection cradle directly in front of the coin sensing pin, Figure 11.4, Arrow A. The motion of the coin is halted here by the first tooth of the coin holding bar, which is indicated by Arrow B in Figure 11.4. Because of the small cut in the face plate in front of the coin sensing pin, shown by Arrow C in Figure 11.4, thin coins as well as undersize coins are pushed out through the front by the coin sensing pin and slide down the slug chute (previously removed) to the left side of the case.

The coin holding lever assembly located on the back side of the escalator, Figure 11.5, Arrow A, senses when the coin has been "accepted" by the escalator by the lower end of it being displaced from the detection cradle. The upper end of the lever then moves into the coin slide, Figure 11.4, Arrow D, thereby preventing any additional coins from entering the detection cradle area which could cause jamming. This lever must work freely, since if it became stuck, it would cause rejection of all coins which enter the chute. It is not uncommon for this lever to have been removed from the escalator so as to eliminate potential problems of sticking.

The anti-jam lever, Figure 11.4, Arrow E, is a freely pivoting lever which allows the coin to pass down and by it into the cradle but prevents it from being forced back up into the coin slide. Thus, once a valid coin enters into the escalator cradle, its only method of exit is to the right, along the escalator track. This little lever must be free to rotate in order to prevent clogging of the coin chute and is sometimes removed for just that reason.

Once the coin (or check), has settled in the detection cradle, Figure 11.4, Arrow A, the coin is ready for detection. When the handle of the slot machine is pulled down, the mechanism attempts to push the coin detector lever, Figure 11.6, Arrow A, and coin

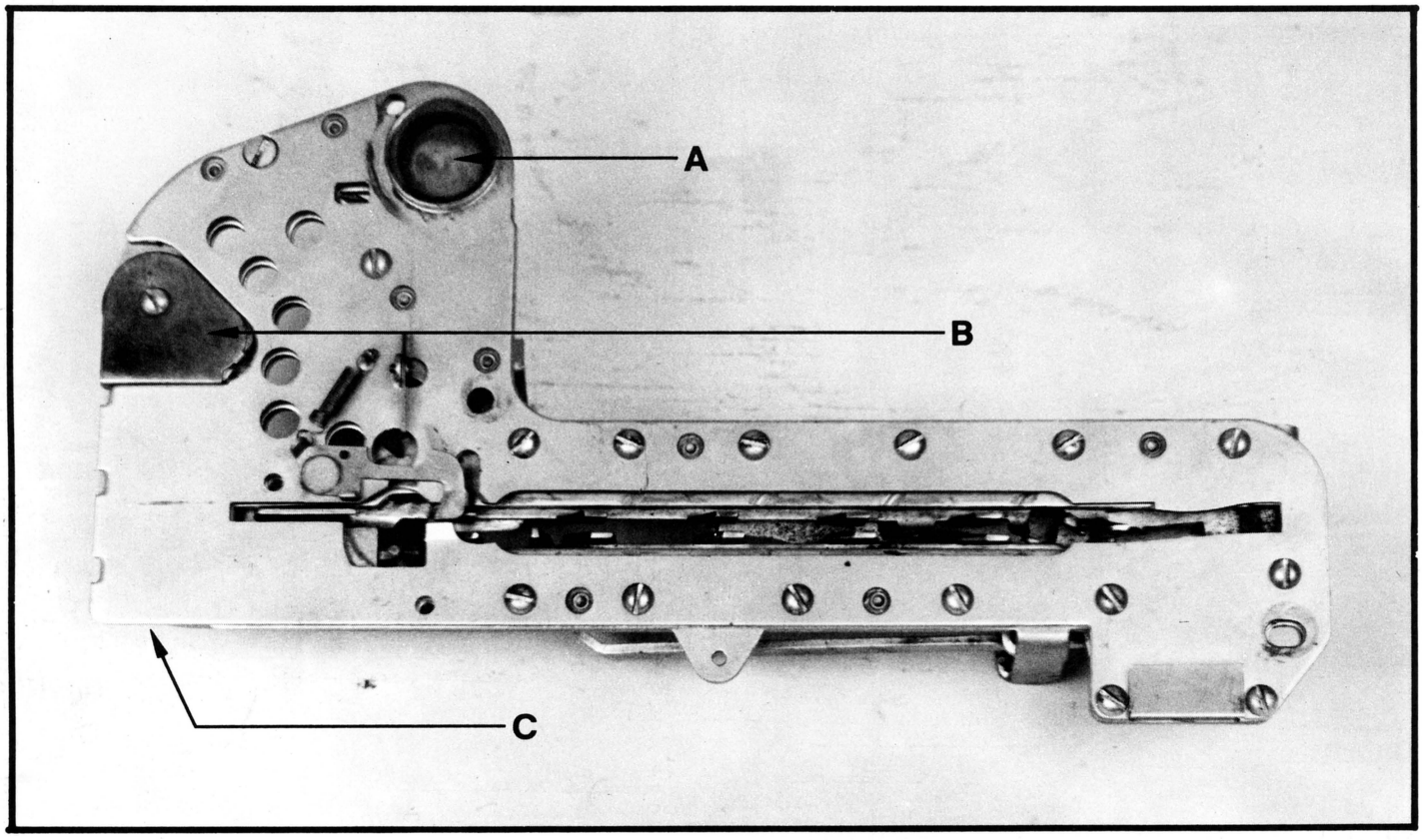


Figure 11.3

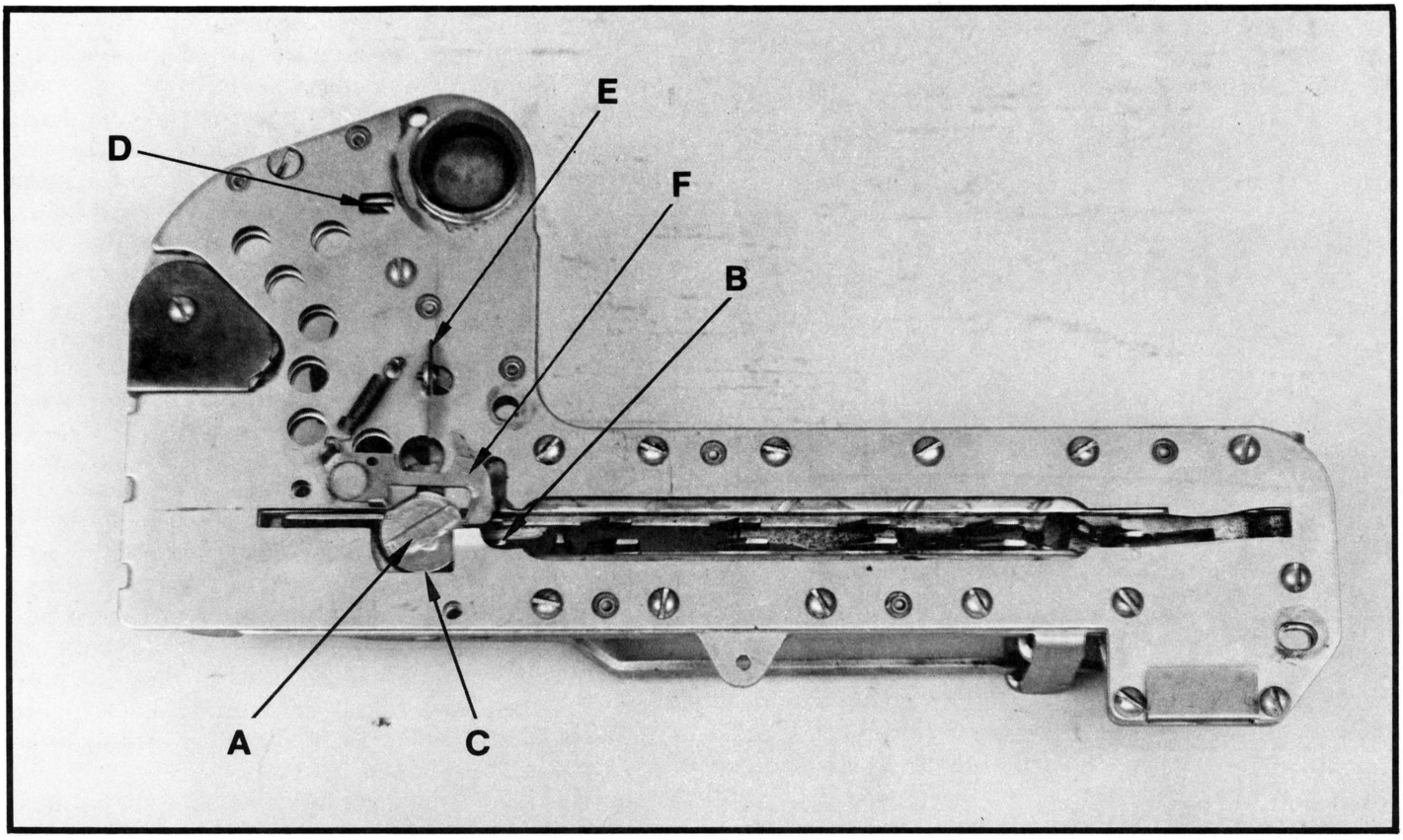


Figure 11.4

sensing pin, Figure 11.6, Arrow B, forward. If there is a valid coin or check in the cradle and the length of the sensing pin has been properly adjusted, the forward motion of the detection lever will be restricted. When the mechanism senses this restraint, it will then begin its wind-up cycle and cause the escalator to enter its coin advance phase.

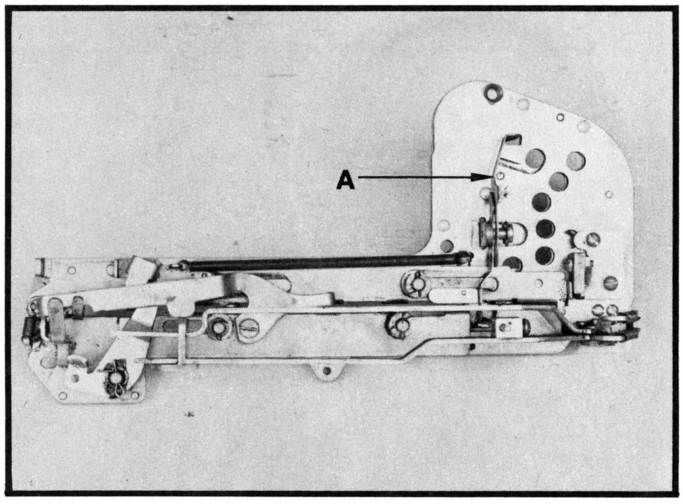


Figure 11.5

Coin Advance Phase

Figure 11.7 shows the interface between the coin advance bar operating lever (held in left hand) with the escalator while the mechanism is in the ready state.

During the wind-up cycle of the mechanism, the coin advance bar operating lever begins to travel downward. During its first one-half inch of travel, it releases the coin advance bar locking lever, shown by Arrow A in Figure 11.8, and this lever is lowered by the tension placed on it by its extension spring. Simultaneously the coin bar release lever, as shown by Arrow B in Figure 11.8, is released and it is lowered by the tension placed on it by its extension spring. At this point, the mechanism's coin advance bar engages the escalator coin advance bar lever, as shown by

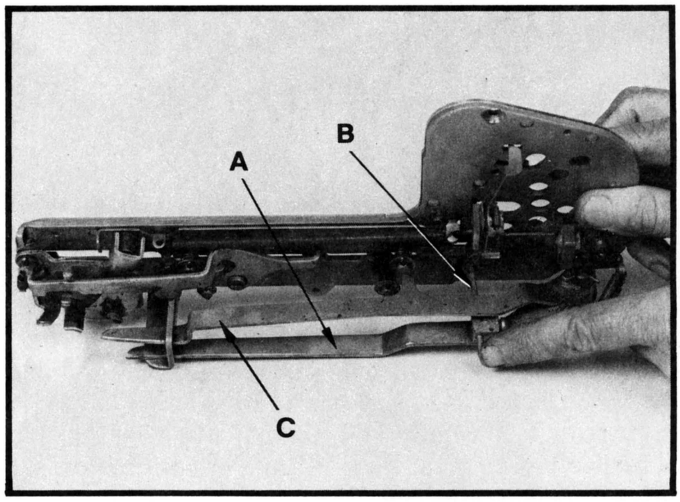


Figure 11.6

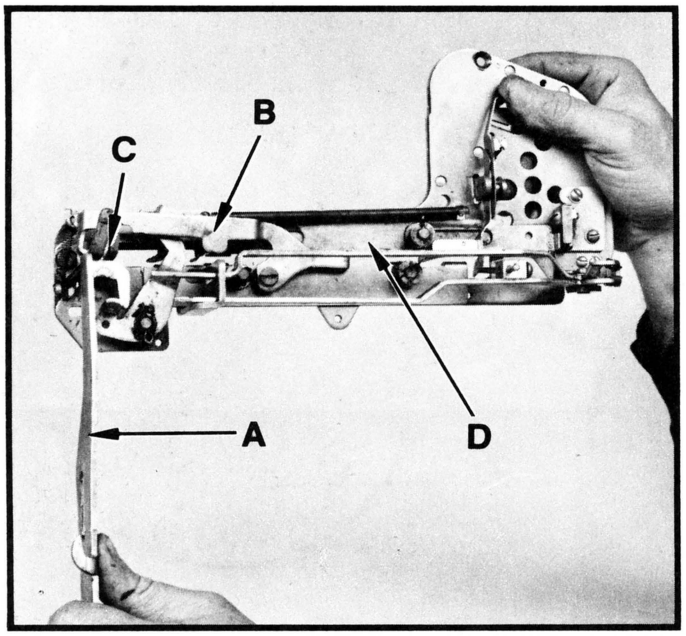


Figure 11.7

Arrow C in Figure 11.8, which in turn begins to slide the coin advance bar, as shown by Arrow D in Figure 11.8, thus moving the coin(s) to the left as seen from the rear of the escalator.

During this phase of the escalator cycling, the escalator itself provides a further check on the presence of a coin. Figure 11.4 shows a coin in the escalator detection cradle just before it begins to travel. In order for the escalator coin advance bar to slide, it is necessary

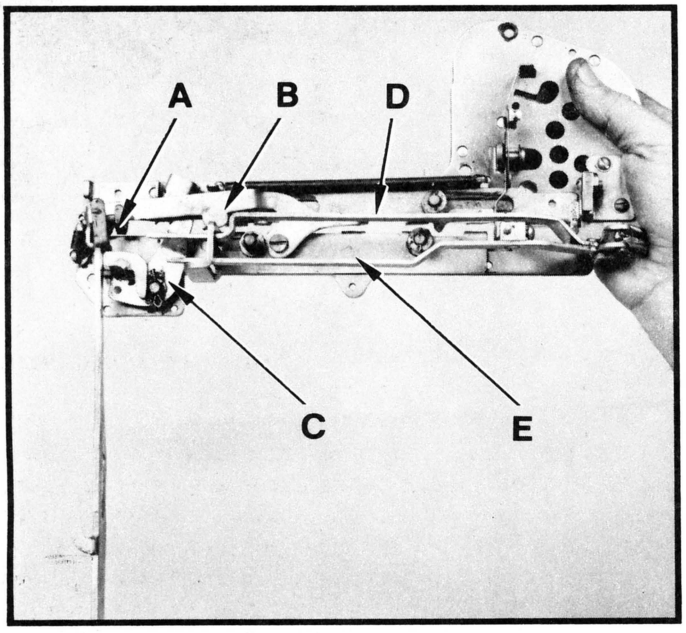


Figure 11.8

for the coin which is leaving the coin detection area, to raise the coin advance bar holding lever, indicated by Arrow F in Figure 11.4, thereby allowing the coin advance bar to slide freely. If no coin is present, the lever will not raise, and the escalator mechanism will lock the coin advance bar and lever, thus preventing further travel of the coin advance bar operating lever.

The coin advance holding lever is an anti-cheat device and prevents the machine from being cycled while in the case by holding back on the coin detection lever bar. While its utility in a casino environment is valid, it is not a desirable feature for home use, and it can sometimes be quite troublesome since it not only prevents the cycling of the machine while in the case without using a coin, but also leads to potential jams which can only be released by pushing the wire connected to the operating lever lock, described in the mechanism chapter. For home use, the coin advance holding lever may either be removed or locked in the full upward position.

After the coin advance holding lever has been raised, the coin advance bar, indicated by Arrow D in Figure 11.8, continues moving to the left (as viewed from the rear of the escalator). The coin holding bar, shown by Arrow E in Figure 11.8, which is spring loaded, is moved back, and the coin is advanced past its "tooth" to the next position. After the coin advance bar has been advanced to its farthest left position, indicated by Arrow A in Figure 11.9, it is locked in this position by the coin advance bar locking lever, Arrow B in Figure 11.9.

Before the machine can finish its wind-up phase, it must determine whether a coin or a check was placed in the escalator. This determination is accomplished by the mechanism's check detector operating arm pushing forward on the escalator check detector lever, indicated by Arrow C in Figure 11.6. The prong extending from this lever,the check sensing prong, then senses whether there is a hole in the center of the coin which is being played. If the check detector lever is restricted as it is moved forward (indicating there is a solid coin present), the mechanism will then continue the wind-up cycle in a normal manner. If, however,

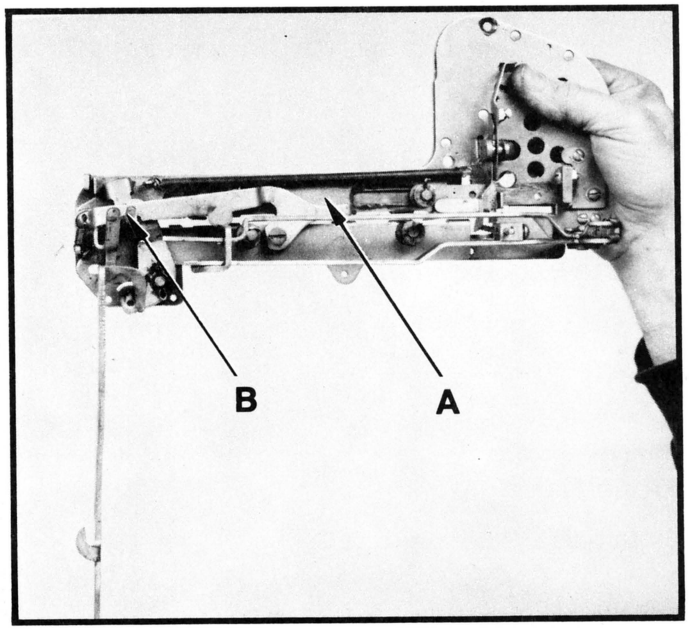


Figure 11.9

the check detector lever is free to travel forward (indicating a check with a center hole), the mechanism will then payout (or prevent payout) for check play depending upon the position of the anti-check payout control lever as described in Chapter 7.

The Reset Phase

When the mechanism has entered its unwind phase and has released the payout levers, it simultaneously releases the coin advance bar operating lever, allowing it to return to its upward ready position as shown in Figure 11.7, Arrow A. As the coin advance bar travels upward, it resets the coin bar release lever against the coin holding bar as shown by Arrow B in Figure 11.7, so that no other coin can pass until it is released during the next cycle. The coin advance bar operating lever also releases the escalator locking

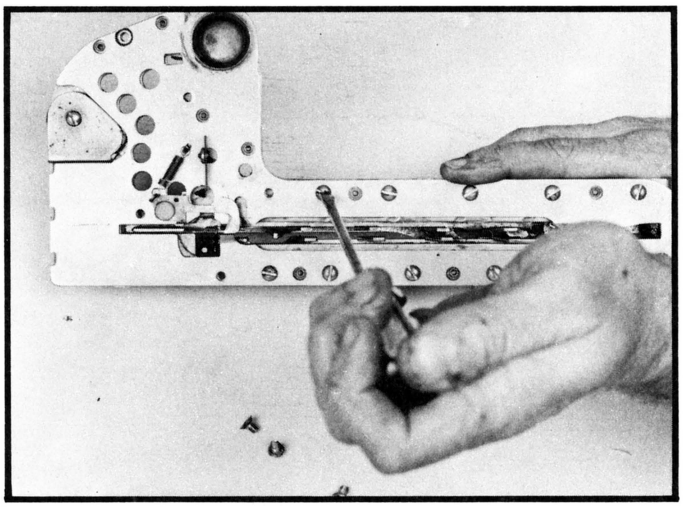


Figure 11.10

lever, indicated by Arrow C in Figure 11.7, allowing the coin advance bar to return to its right-hand reset position as shown in Figure 11.7, Arrow D.

Escalator Overhaul and Cleaning

The coin chute front plate is removed from the

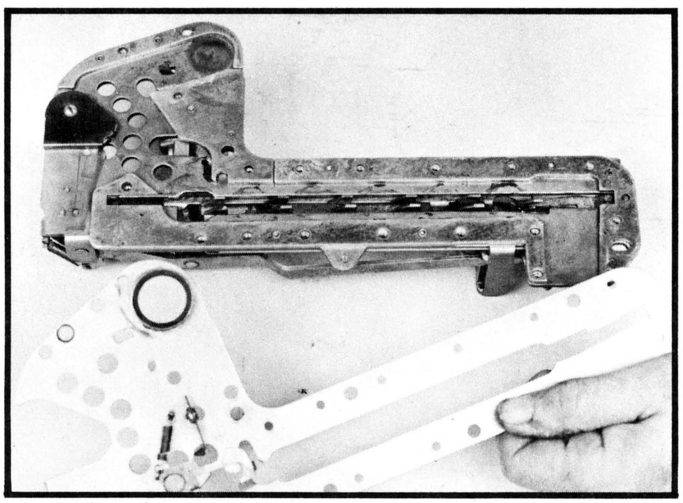


Figure 11.11

body of the escalator by removing the fifteen machine screws as shown in Figures 11.10 and 11.11. The coin chute front plate should be thoroughly cleaned and

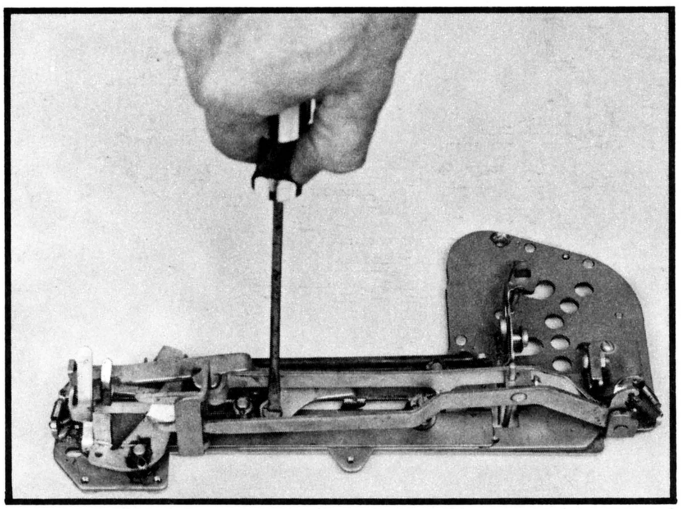


Figure 11.12

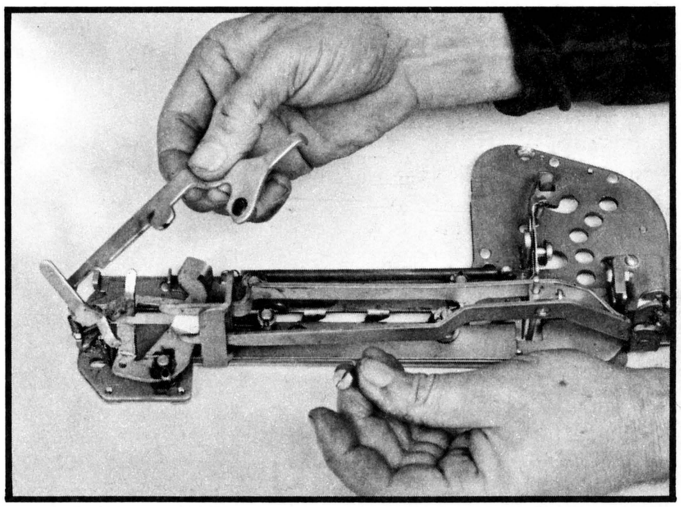


Figure 11.13

wiped dry with fast evaporating solvent. The coin chute itself, on the body of the escalator, should also be thoroughly cleaned and brushed and wiped clean with fast evaporating solvent.

Further disassembly of the escalator is accomplished by removing the levers and bars from the back side. The coin bar release lever assembly is removed with its extension spring as shown in Figures 11.12 and 11.13. The coin advance bar locking lever is removed with its extension spring as shown in Figures 11.14 and 11.15. The coin advance bar lever assembly is removed as shown in Figures 11.16 and 11.17 with its extension spring. Finally, the coin advance bar assembly and its extension spring are removed from the frame of the escalator as shown in Figures 11.18 through 11.21. It is necessary to remove the small cotter pins holding the retaining washers and the springs before the bar can be freed from the main assembly.

Further disassembly is not really necessary, since

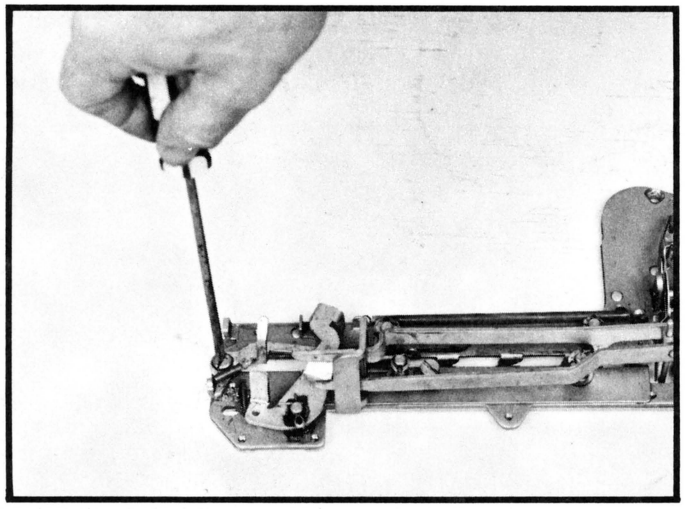


Figure 11.14

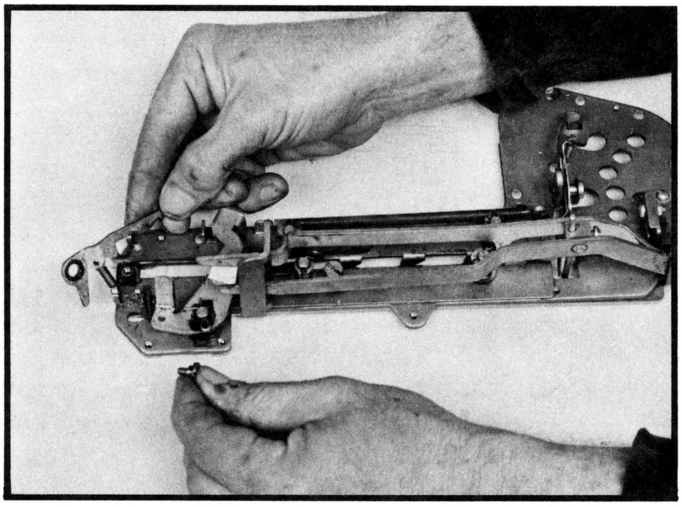


Figure 11.15

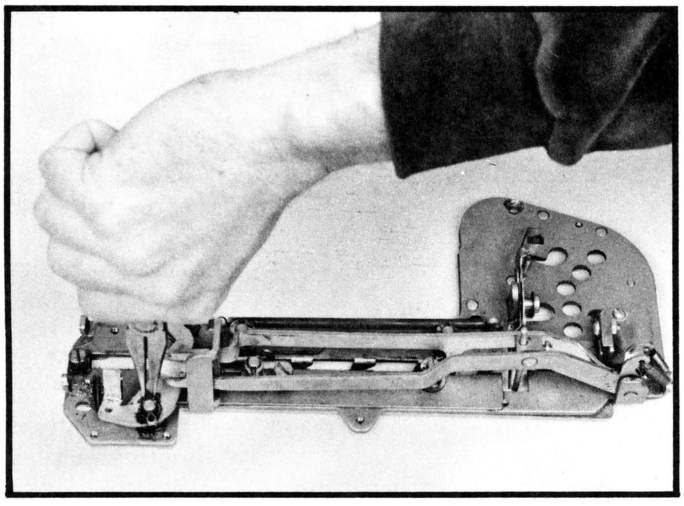


Figure 11.16

most of the major components have been removed from the escalator and the remaining components can generally be cleaned thoroughly with solvent and lightly oiled. The coin advance bar also should be thoroughly cleaned with a fast evaporating solvent and the teeth should be checked for excessive wear. The rule of thumb for oiling the escalator is to *never* put any oil on parts which come into contact with the coins. Oil should be lightly applied, however, to the levers' shoulder screws, between the coin advance bar

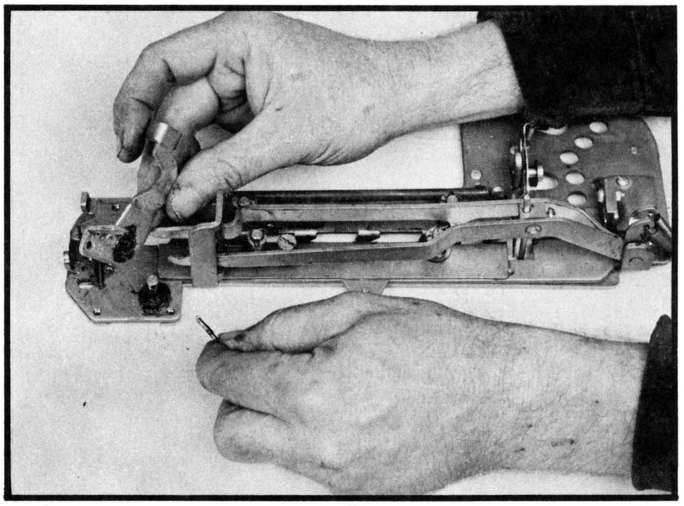


Figure 11.17

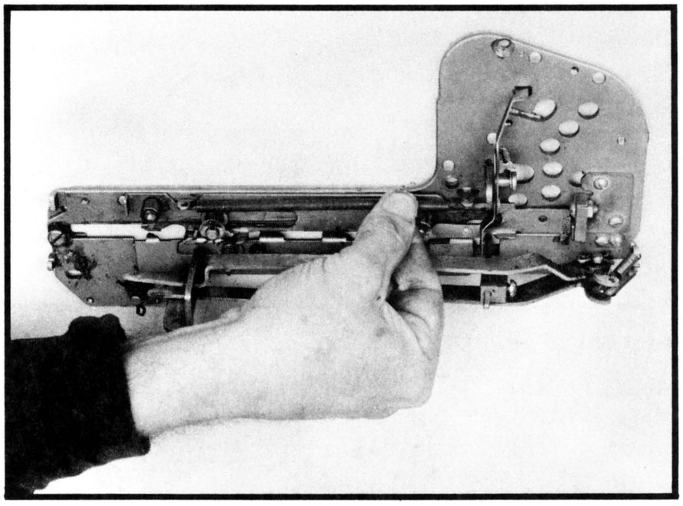


Figure 11.18

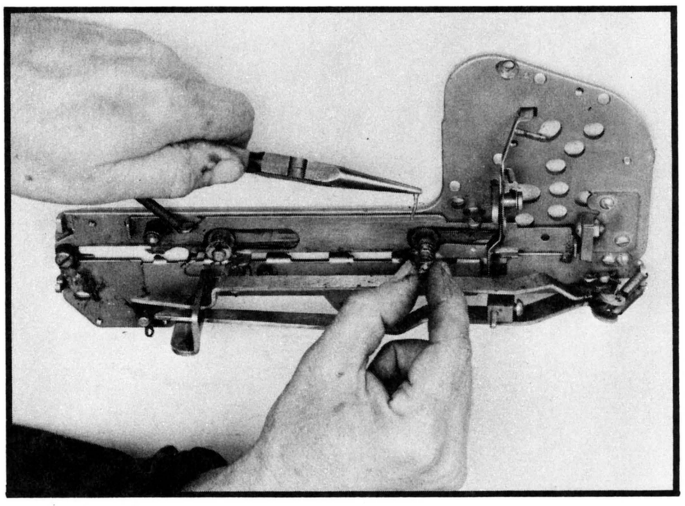


Figure 11.19

and the main plate of the escalator and on the points where the four compression springs apply pressure to the two plates.

The assembly of the escalator is straight forward and is accomplished by reversing the steps outlined

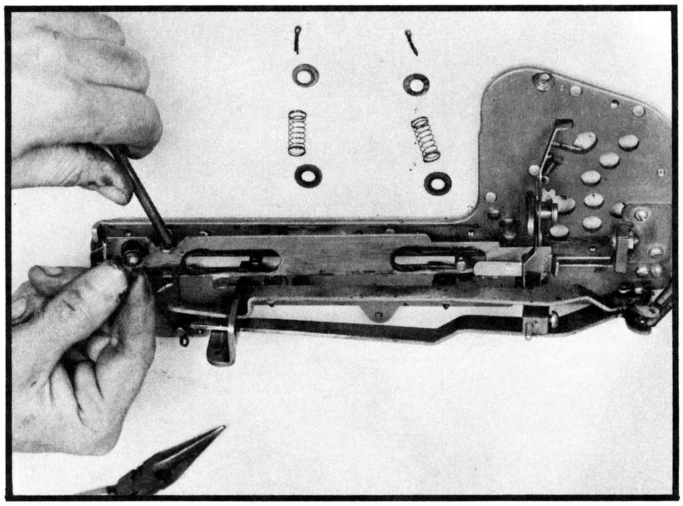


Figure 11.20

for the disassembly of the escalator. The escalator should be cycled with coins several times by hand before installation into the case to make sure the action is crisp and smooth.

The installation of the escalator into the case is followed by reversing the steps outlined in the section of escalator removal. One word of caution should be kept in mind when installing the escalator in the case. Quite frequently the threads in the case have been

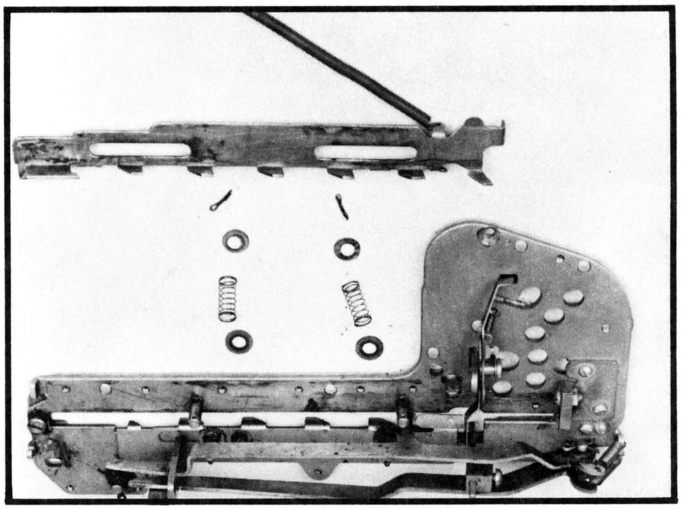


Figure 11.21

worn or stripped such that the screws used to mount the escalator will not tighten firmly. If the screws cannot be tightened, the threaded holes need to be drilled and retapped to take the next larger size screw (namely a number 12-24), and these larger screws substituted for the old number 10-24 screws. The proper drill size for a 12-24 tap is a number 16 (.177″ diameter). Take care to only drill to the bottom of the existing hole; drilling too deep may result in the drill completely penetrating the case! It is imperative that the three screws holding the escalator to the case are all tight, since their working back and forth in the front casting will eventually result in stripping the threads in the aluminum.

12 The Handle and Pump Assemblies

Introduction

The basic function of the handle and pump linkage was described briefly in Chapter 2. The components of this system receive hard use, and it is essential to keep them well lubricated. They should be overhauled occasionally to assure clean and smooth operation.

There are two common types of handles used on the later Mills machines. The one pictured here is referred to as the pistol grip type, and the other one (not pictured) is referred to as the club or casino type. The pistol grip handle is approximately 10″ long and was designed to aesthetically conform to the design of the machine. The casino handle is a straight metal shaft with a ball, similar to a gearshift knob on the end of it. Because the casino handle is approximately 13″ long versus the 10″ for a pistol grip, it requires less effort to operate the machine. However, the casino handle is not a particularly aesthetic piece of equipment; it is used in casinos where its main function is to make it physically easy to play the machines. It is not an uncommon complaint for people using pistol grip machines to claim that the machine doesn't work easy enough, since the extensive use of the casino handles has conditioned players to the easier pull.

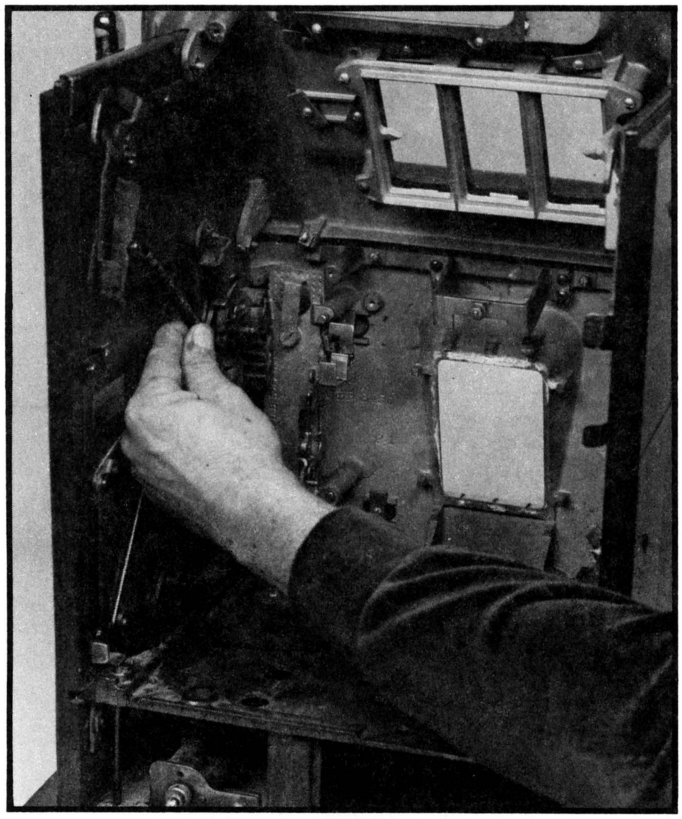


Figure 12.1

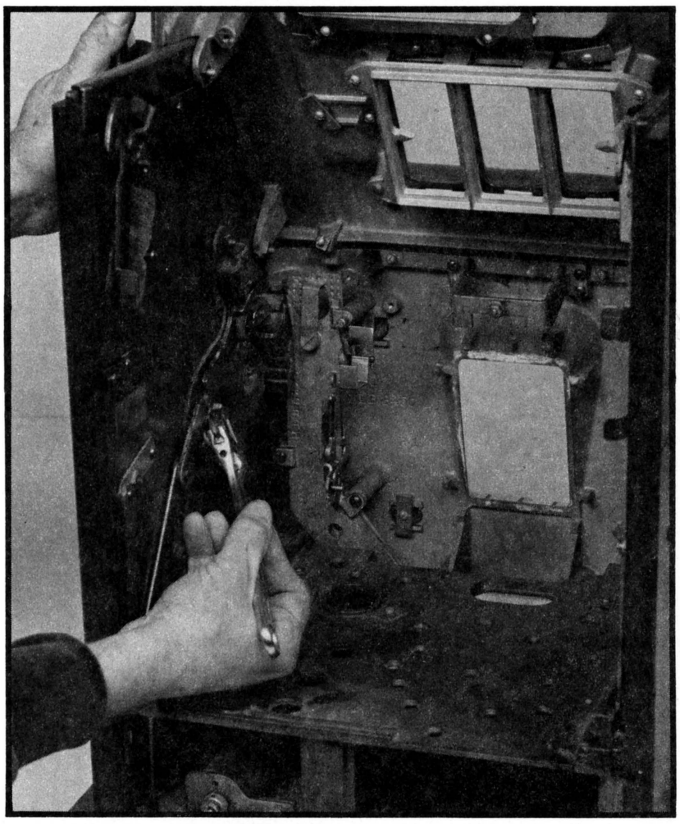


Figure 12.2

Handle Removal

The first step in the removal of the handle is to disconnect the handle return spring shown in Figure 12.1. After this spring is removed, the handle is grasped in one hand while the nut fastening the car-

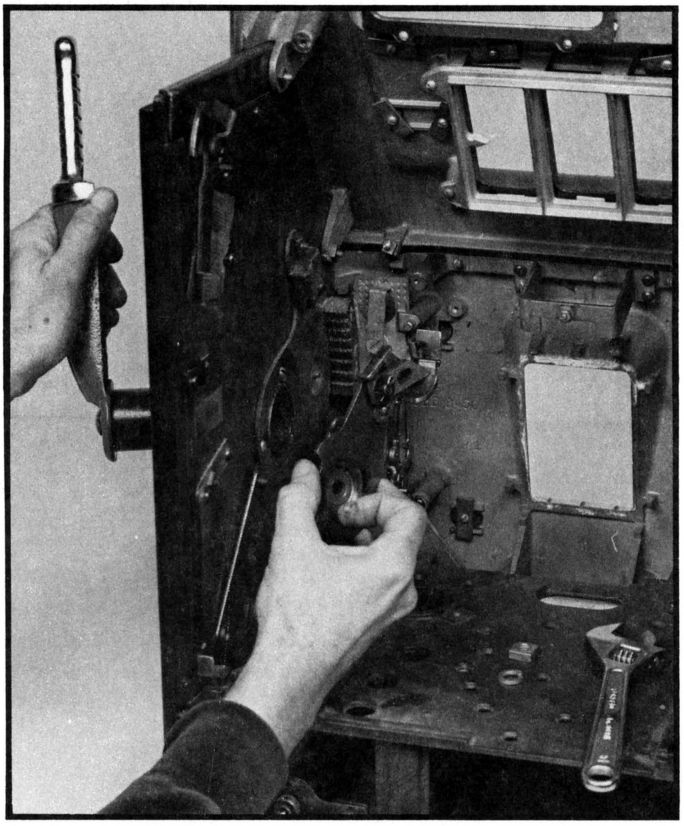


Figure 12.3

riage bolt through it to the machine is removed, as shown in Figure 12.2. When this bolt has been removed, the handle may then be pulled away from the

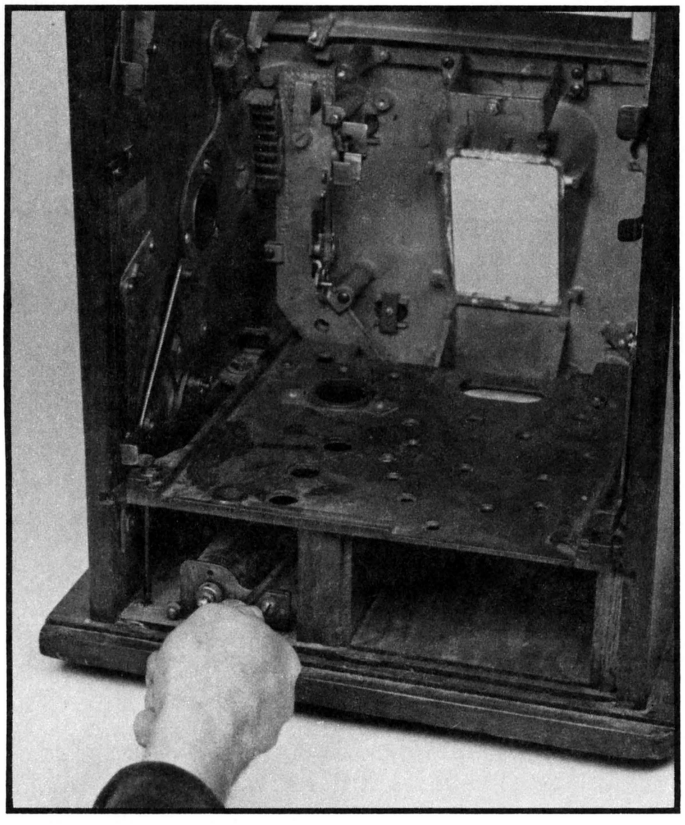


Figure 12.4

mechanism as shown in Figure 12.3 and the handle starting lever removed away from the bushing, to allow access for cleaning of both the bushing and the starting lever. Both the handle and the bushing should be thoroughly cleaned and new grease applied before reassembly. It is generally not necessary to remove the bushing, but once the three holding screws are exposed inside the case, they should be tightened to assure that the bushing mounts tightly to the case.

It is usually not necessary to remove the linkage from the case, since it is easily accessible for periodical lubrication with an oil can.

Pump Removal and Disassembly

The pump is removed by unscrewing the forwardmost screw as shown in Figure 12.4, and then the

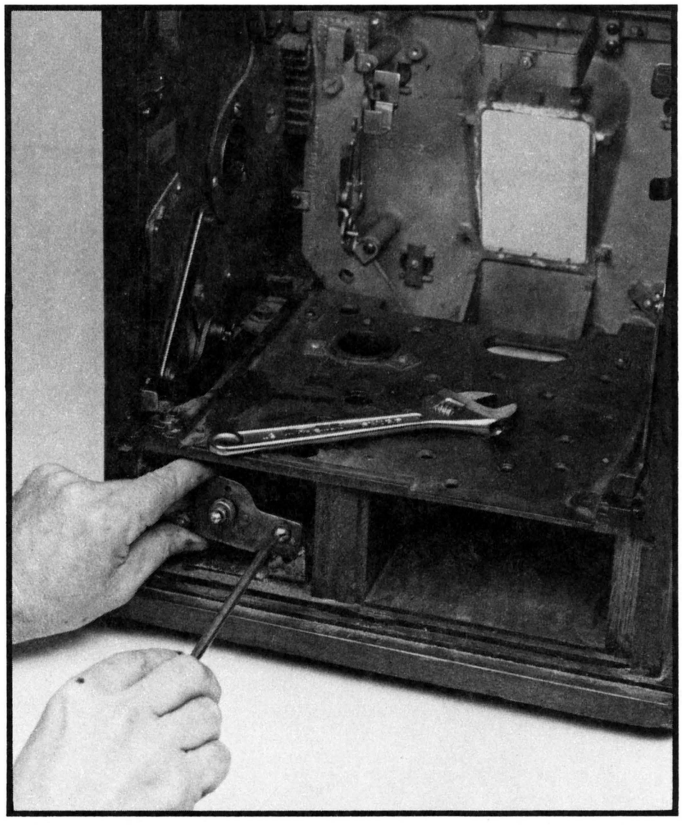


Figure 12.5

rearmost screw as shown in Figure 12.5. The pump is removed by placing the handle in the fully forward position. By moving the pump it will slip off of the post at the end of the linkage and can be removed by pulling it toward the rear of the machine.

Once the pump has been removed, it is disassembled by loosening the nuts at each end of the shaft, which holds the two ends of the pump assembly together as shown in Figure 12.6. When this shaft has been disconnected, the pump is pulled apart as shown in Figure 12.7, and the plunger and cylinder cleaned. Before assembly of the plunger and cylinder, they should be lubricated with heavy machine oil.

The pump is assembled by reversing the process of

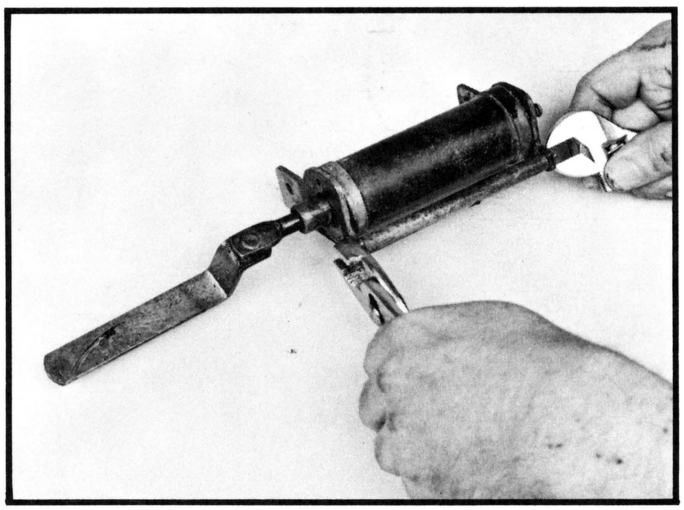


Figure 12.6

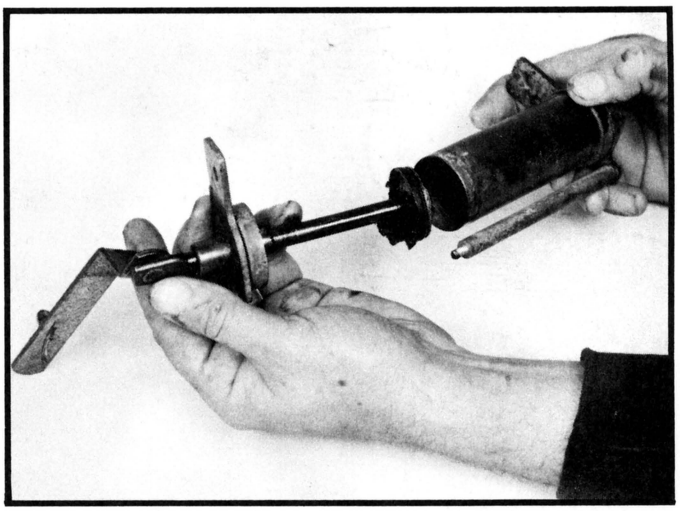


Figure 12.7

the previous paragraph. Its insertion back into the case may require a little fiddling, but it is a relatively straight forward process when the handle is in the full down position.

13 The Award Token Assembly

Operating the Token Dispenser

The function of the award token assembly has been described in Chapter 2. It is a simple escapement type assembly and is used for the dispensing of a token approximately once every 8,000 plays of the machine.

The dispenser is filled by inserting the tokens at the top of the chute. The tokens are entered into this chute by moving the holding bar, as shown in Figure 13.1, to either side by loosening its screw where the screwdriver is shown to be. After the tokens have been placed in the chute, the bar should be returned to the vertical position and its holding screw tightened. This prevents the tokens from falling out of the chute, should the machine be jarred or turned upside down.

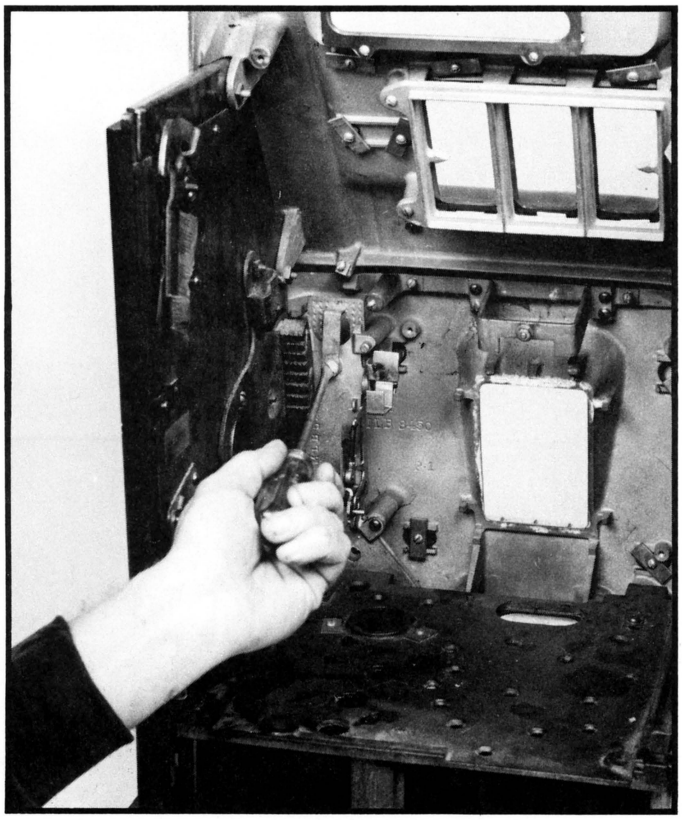


Figure 13.1

The action of the token dispenser can easily be checked by pushing on its release arm. The assembly should release one token when pushed, and upon release, all the remaining tokens in the chute should drop down one token length.

Award Token Assembly Removal

The award token assembly removal is complicated by the access to one of its mounting screws, as shown by the index finger in Figure 13.2.

First, remove the operating lever arm as described

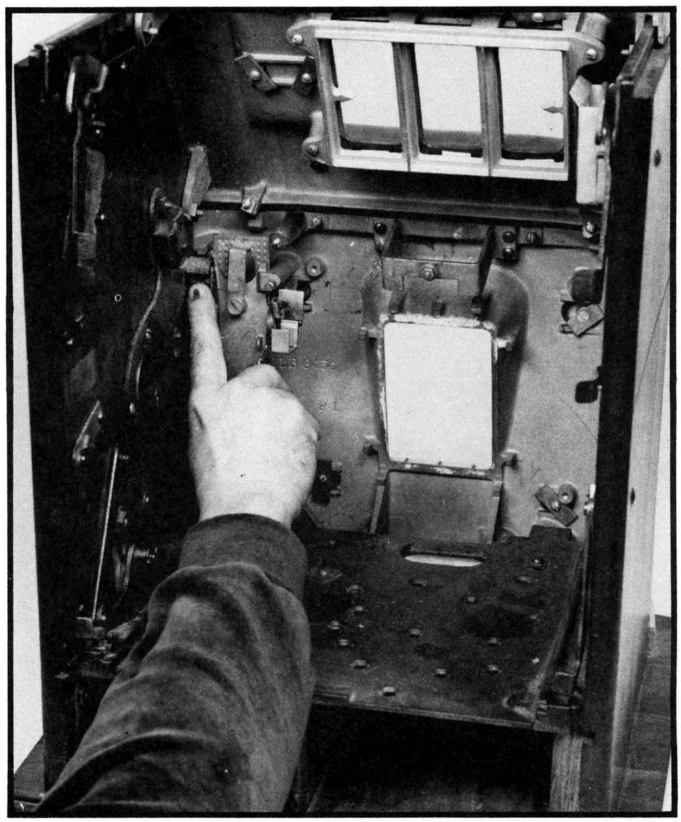


Figure 13.2

in Chapter 12. Next, remove the arm bushing by removing the three screws as shown in Figures 13.3 and 13.4. Now remove the handle starting lever bracket

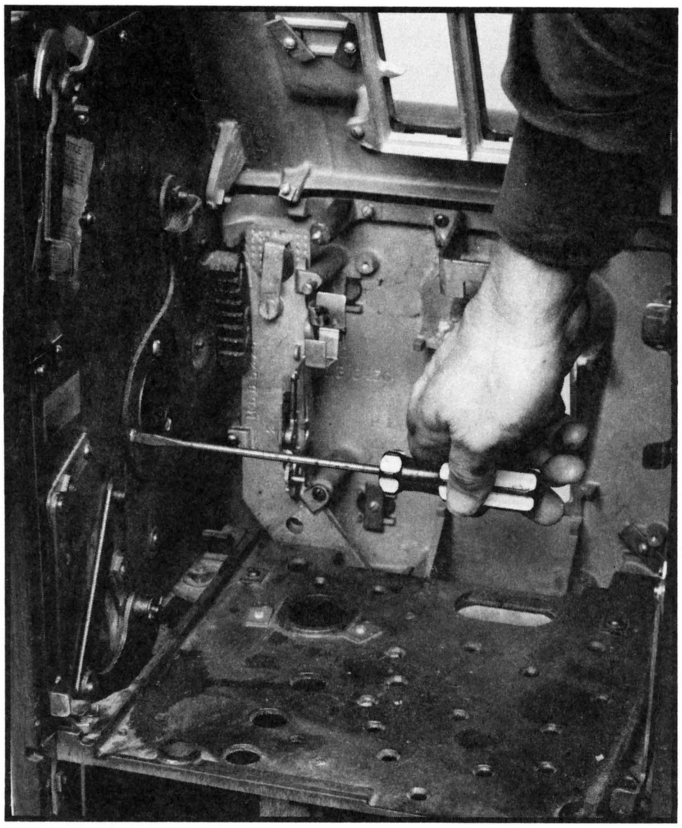


Figure 13.3

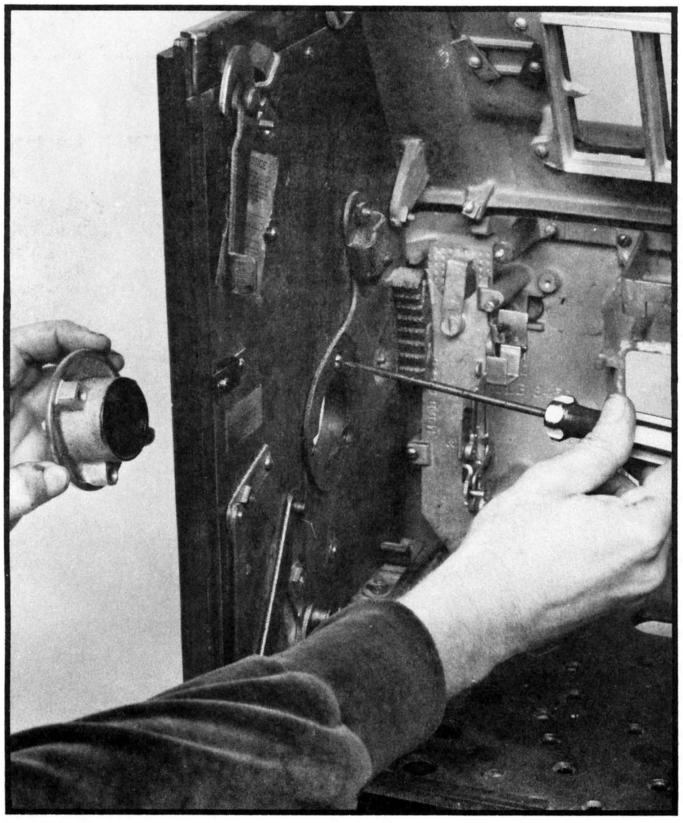


Figure 13.4

assembly as shown in Figures 13.5 and 13.6, by removing the two nuts attaching this assembly to the case. Removing this assembly provides access to the necessary screw. Removing the other three screws, as shown in Figures 13.7 and 13.8, allows the assembly to be removed from the case.

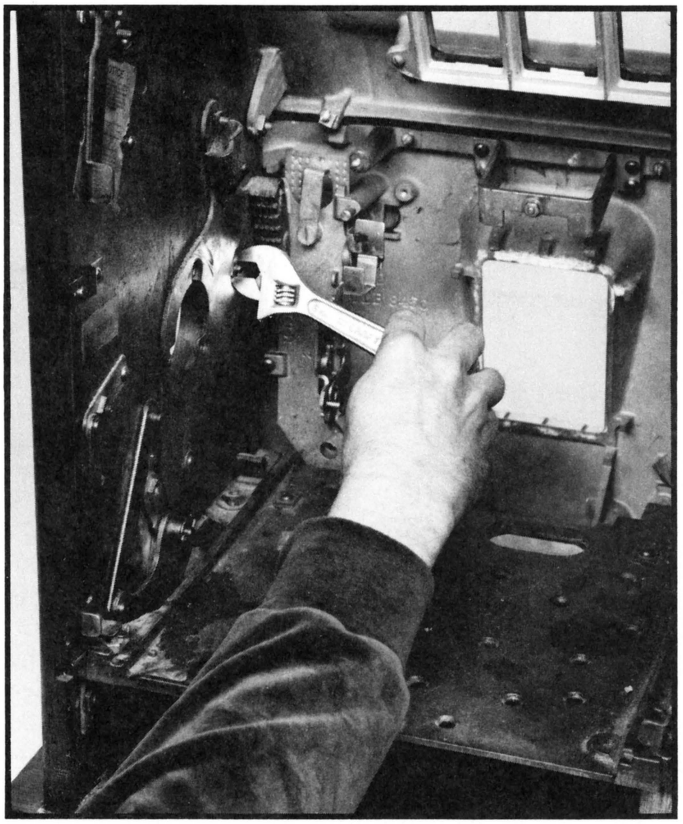


Figure 13.5

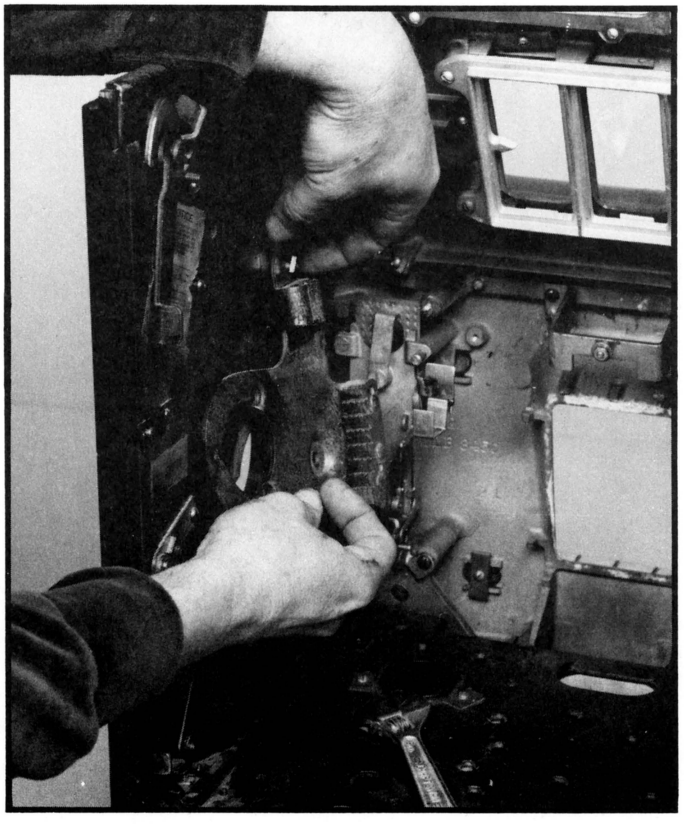


Figure 13.6

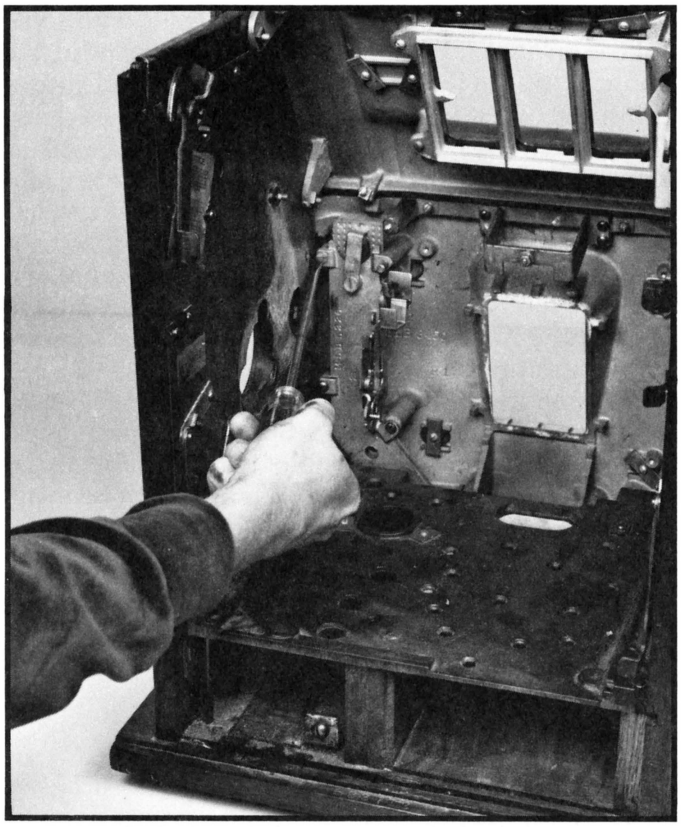


Figure 13.7

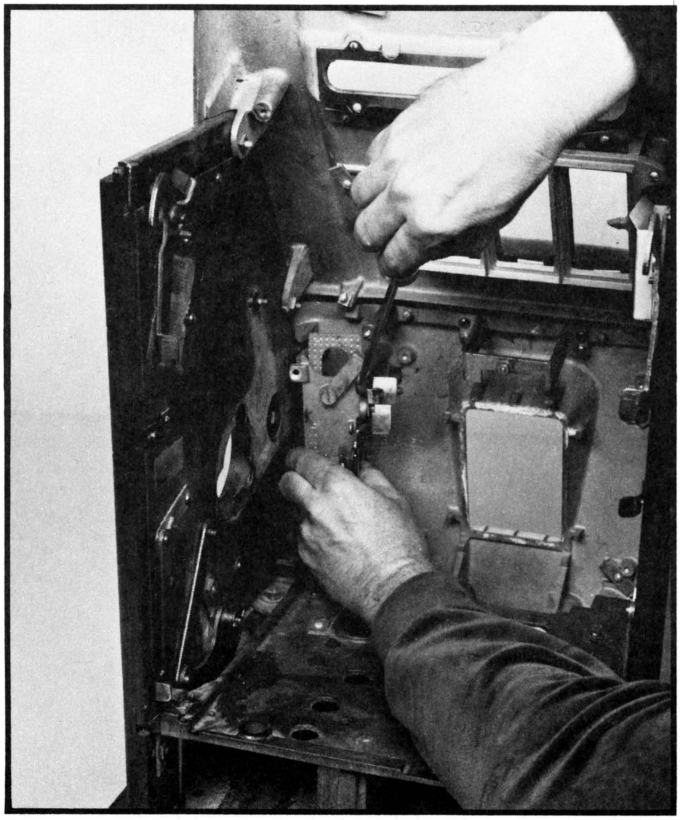


Figure 13.8

Once the chute has been removed from the case, it may be cleaned, oiled and maintained as appropriate. Assembly requires the reverse of the procedures outlined above.

The Theory of Operation

The theory of the operation of the award chute can

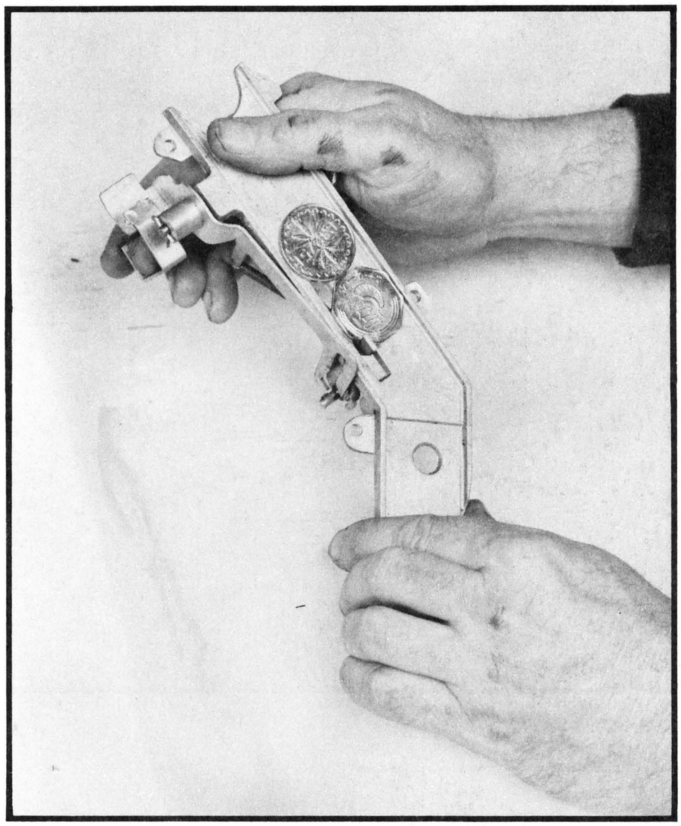


Figure 13.9

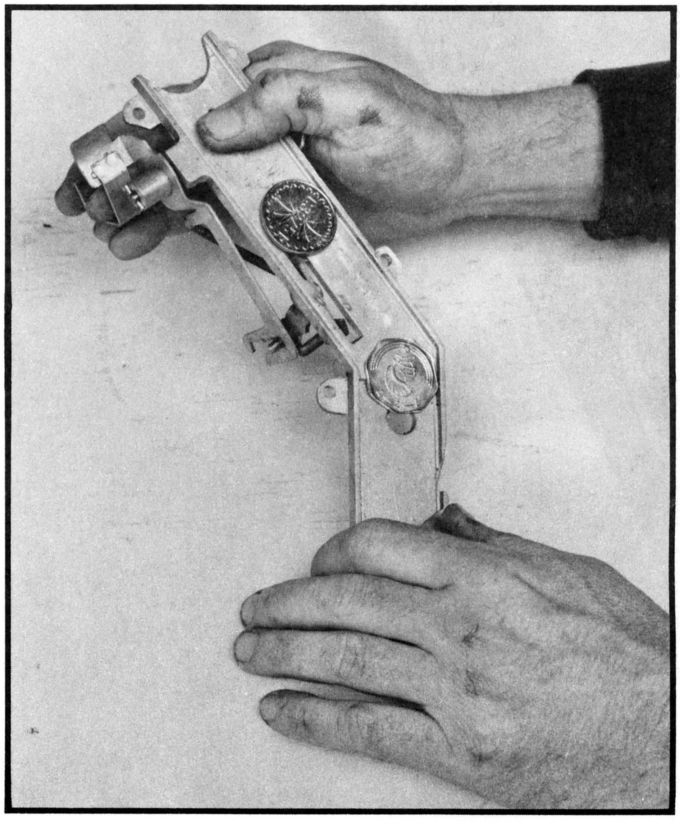


Figure 13.10

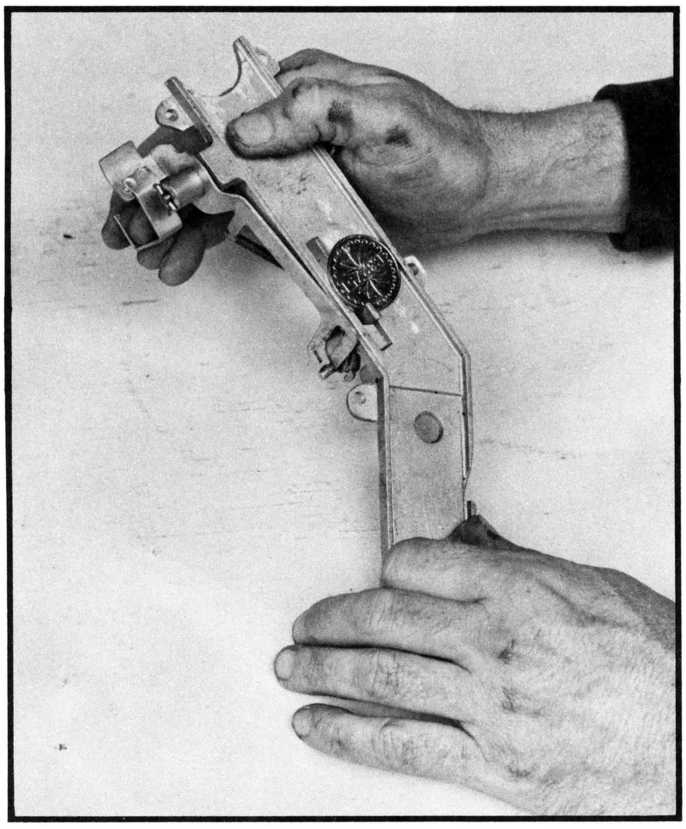


Figure 13.11

best be seen by looking at the award chute with some tokens in it. In Figure 13.9 two tokens are in the chute, resting in their normal position. When a special award has been achieved (i.e., 7-7-7 on the payline), the bottom token in the chute is then released as shown in Figure 13.10, while still holding the remaining token(s) in their place. After the mechanism has been recycled, the award token release pushbar is pulled back, away from the award token chute and thus the mechanism is reset, allowing the token(s) in the upper portion of the chute to fall and come to rest upon the stop as shown in Figure 13.11.

It is important that the diameter of the tokens used in the award check assembly be exactly what the assembly was designed for, since any appreciable variation in token diameter will prevent the assembly from working.

14 Machine Adjustments

Introduction

The chapter on machine adjustments has been inserted at the end of this book, because in most cases the adjustments need to be made on a completely assembled machine. The first chapters of this book have described the overhaul and theory of operation of the machine. There are two reasons for making adjustments on a machine: (1) to compensate for the wear and tear incurred on the machine; and (2) to adjust the machine after overhaul and/or new parts have been installed.

Since wear and tear on the machine is usually the cause of the machine's malfunction, it is the compensating adjustments that represent a major portion of "fixing" a malfunctioning machine. However, wear and tear may not be solvable by adjustment and the cure may require repair or replacement of a part that has worn out. When parts need to be replaced, it is usually desirable to overhaul the machine. Some of the most complicated adjustments and problems arise because of interface situations between the mechanism and the escalator and/or the jackpot. Because of the complexity of those interfaces, an understanding of the theory of operation is required.

There are three basic types of adjustments which are addressed in this chapter: wrench or screwdriver, spring tension and bending. Wrench and screwdriver adjustments are from the first group of adjustments and are the classical adjustments provided by the manufacturer. Springs have a tendancy to fail (for many reasons) with age and may represent a universal problem to any machine incorporating spring tension, and the amount of tension required of the springs is best applied when the function of the parts is understood. Bending of parts in the mechanism due to operation of the machine, is the direct result of wear and tear on the affected parts; it is also a simple way to compensate for wear and tear to remedy a malfunctioning machine.

The order of adjustments presented in the remainder of this chapter is in a logical sequence for a mechanism, which has been completely overhauled. As each adjustment is made, it should not be necessary to come back and repeat the adjustment if the steps are followed as described in this sequence. This philosophy, however, applies only to mechanical adjustments, and not to spring or bending adjustments. The philosophy of this chapter is not a trouble-shooting guide, but an explanation of the adjustments available, what their functions are and the way they should be made.

Escalator Coin Sensing Pin

The coin sensing pin can be adjusted by loosening its holding screw with a screwdriver as shown in Figure 14.1. The initial setting of this pin is made by first inserting a coin in the escalator and then, from the rear, observe that the coin lands directly in front of

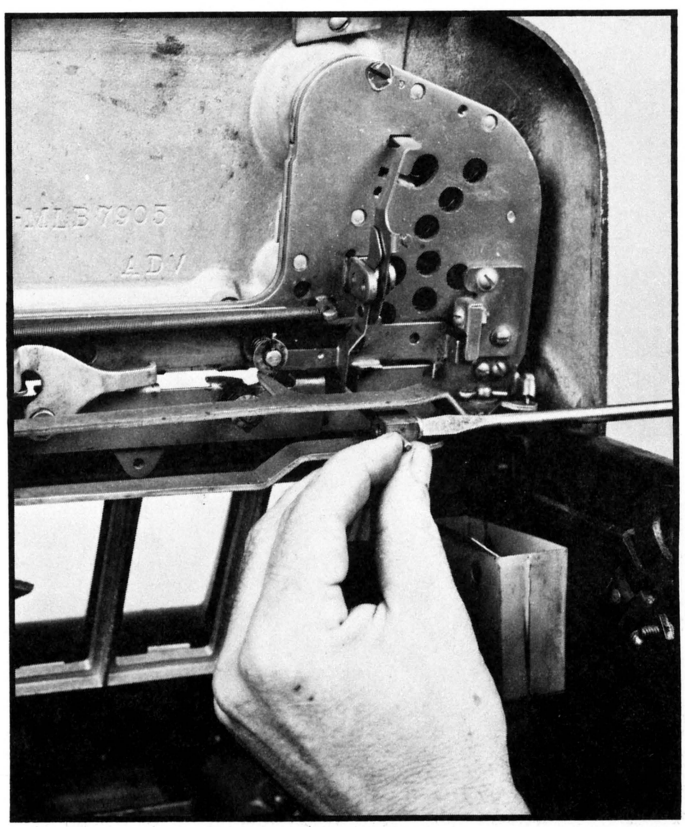


Figure 14.1

the coin sensing pin. The coin sensing pin should be set such that the *end* of the coin detector lever can then be pushed forward approximately ¼", before contact is made between the pin and the coin.

After this pin has been set, activate the handle slowly and observe that the coin sensing pin touches the coin and permits the handle to continue to cycle the mechanism. If it does not continue to cycle the mechanism, the pin must be adjusted so that it does permit cycling of the mechanism by placing it closer to the coin, thus allowing less travel of the coin detector lever arm. As the mechanism continues the wind-up cycle, the coin sensing pin must not cause the edge of the coin to catch on it as it passes to the left; if it does, rotating the coin sensing pin so the end is to the left and towards the center of the coin may help. The pin is properly shaped with two slight bends for this purpose. In addition, smoothing and rounding of the tip of the coin sensing pin will also help. This operation should be repeated over and over to insure that the coin is being properly accepted by the escalator, the pin is applying reasonable pressure on the coin and that the coin is still allowed to slide by the pin in a smooth manner.

Another concern when adjusting the pin, is not to extend it too far forward such that on subsequent plays a coin will sit up on top of the pin and thereby be prevented from falling into the cradle of the escalator. It is the delicate balance between too much pin or too little pin extending that is the proper extending of the pin.

A similar adjustment procedure for the gooseneck-style machine is given in Appendix C.

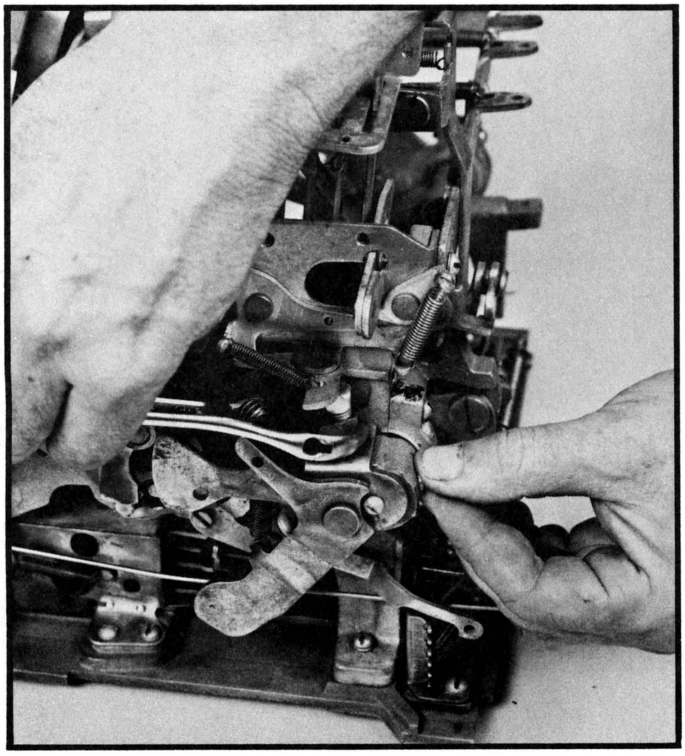


Figure 14.2

Operating Fork Lift Pin

The operating fork lift pin can be adjusted by first loosening the lock nut and then turning back the bolt as shown in Figure 14.2. The protrusion of this pin determines how much the mechanism is to wind up before it starts the reels spinning and begins its unwind cycle. The more that this pin is extended from the fork, the larger the wind-up cycle, consequently the greater the spin. If this pin is too short, the wind-up cycle will not be great enough to either kick the reels or reset the machine timing. The pin should be adjusted to provide just enough wind-up necesary to set the reels into motion and reset the timing since any additional wind-up will cause undue wear and stress on the discs and other working parts and should be avoided.

The actual adjustment of the lift pin itself is very sensitive and should be done while the set screw is hand tight only and by tapping the pin lightly—just enough to move it a few thousandths of an inch—and trying the new setting to see if it is sufficient for the purpose desired. When the machine has been cycled several times manually and the pin position is correct, the set screw should be tightened down firmly and locked in place with the lock nut.

Main Spring Tension

The main operating spring which extends between

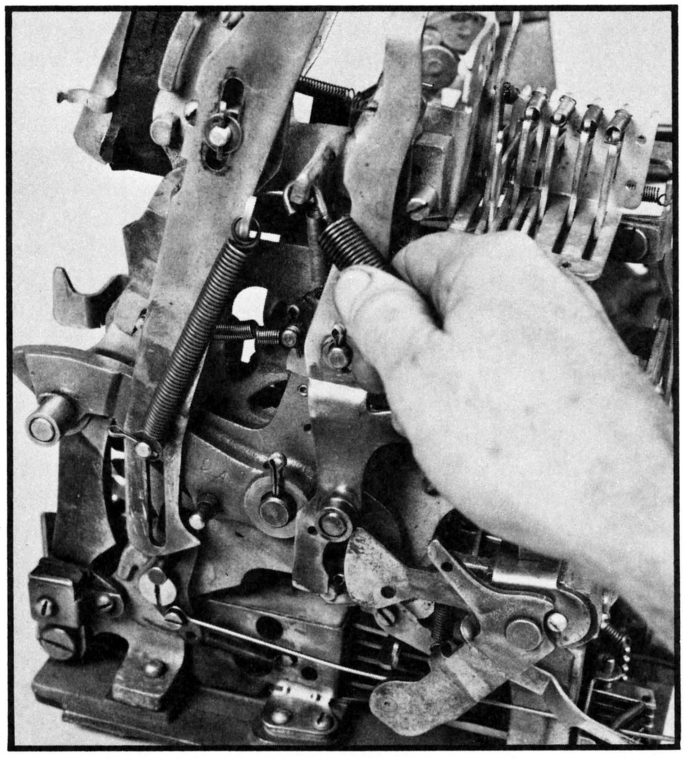


Figure 14.3

the main operating lever and the frame of the machine, is the only spring which has a built in tension adjustment. Once the spring has been removed from the frame as explained in previous chapters, it can be

adjusted as shown in Figure 14.3. The hook is threaded into the end of the spring, such that the tension can be increased by screwing the hook into the spring and decreased by screwing the hook out of the spring.

The function of this spring is to reset the main operating lever and to reset the escalator via the coin advance bar operating lever. The tension of this spring must be adequate to return the coin advance bar operating lever to its fullest upward position while the mechanism is in the case. When either there is too little tension on this spring or the parts which it drives have not been properly lubricated, the coin advance bar operating lever will not return to its full upward position, hence the escalator will be prevented from repeating its cycle, thereby jamming the machine. Proper operation of this spring tension can be observed most easily by viewing the operations of the mechanism from the rear and making certain that the coin advance bar returns to its full upward position at the end of each machine cycle. This is emphasized because, while the bar may travel to its full position when the mechanism is out of the case, it is not guaranteed that it will travel to its full up position when inserted in the case, due to the extra drag and friction of the escalator mechanism itself. This spring should not be over-tensioned but should have just enough tension to return the advance bar. Any time the spring is overtensioned, the mechanism will be unduly hard to cycle and excessive wear will result.

Reel Operating Lever Tension

The adjustment of the reel operating lever (kicker) is performed in one of several ways, depending upon the machine involved. The reel operating lever tension adjustment on the mechanism used in this book is explained first and the other type (shown in Appendix A) is explained second. Increasing the tension on the reel operating lever assembly provides greater initial reel speed during the release cycle of the mechanism. The reason for increasing the initial spin speed of the reels is to provide adequate spin speed until the reel stop levers can engage them. Increasing the tension is not necessarily the cure for sluggish reels since, in many cases, it is the dirty reel assembly which causes premature slowing. In addition, the brake adjustments may be too tight, causing the reels to slow down prematurely. The tension on the reel operating lever mechanism should only be adjusted as a last course of action, since additional tension on the release mechanism will cause additional wear on the discs and possible shearing of the reel shafts. While increasing tension may temporarily solve the problem, it will result in overall wear and tear on the mechanism.

Figure 14.4 shows the extension spring being extended which provides the tension on the reel operating lever assembly. The tension is adjusted by extending the spring beyond its normal length and hooking it to the bracket several coils earlier, thereby shortening its length and increasing its tension.

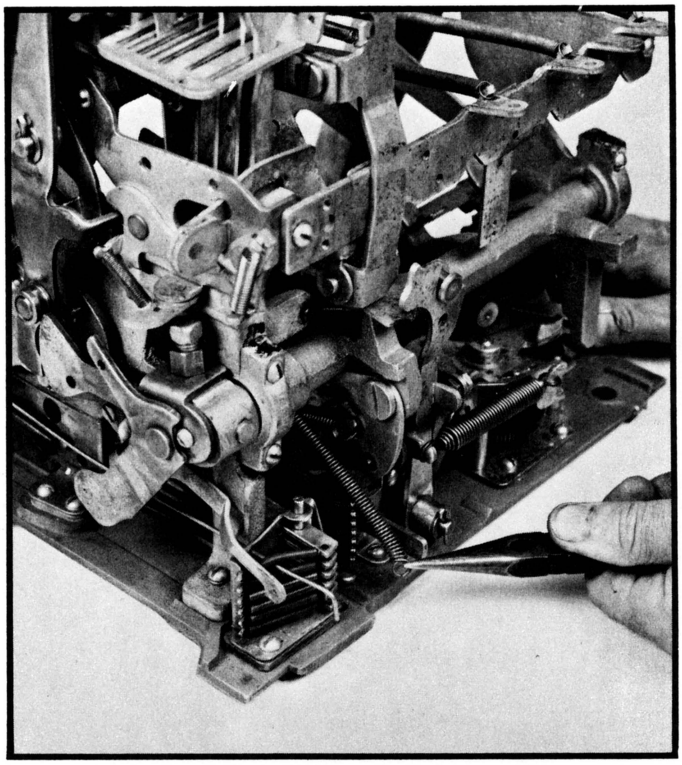


Figure 14.4

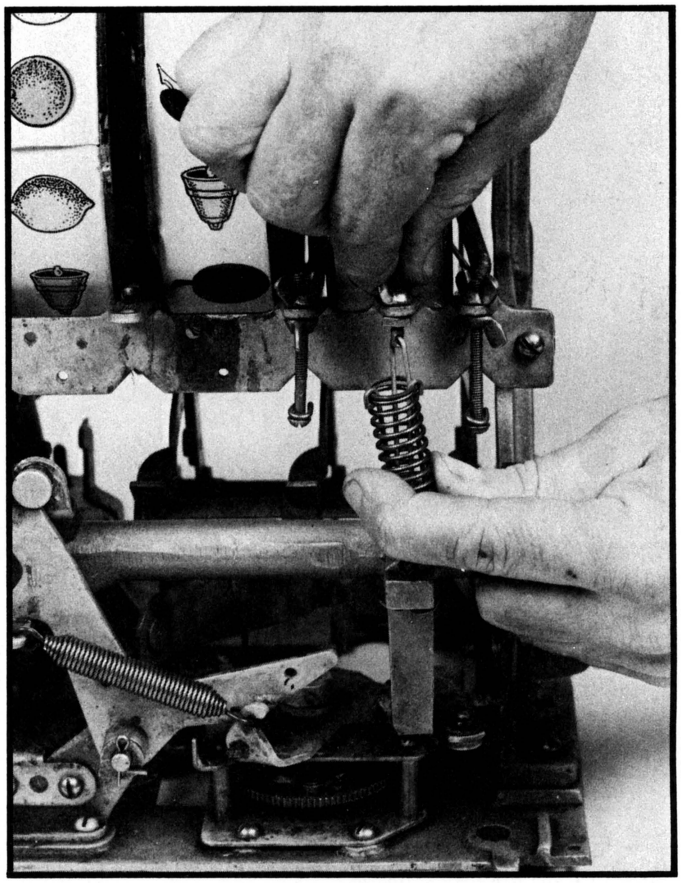


Figure 14.5

On earlier machines, the reel operating lever ten-

sion is provided by the tension on the return spring on the operating fork. This spring is adjusted by loosening the wing nuts and shortening it as shown in Figure 14.5.

One last consideration in adjusting the reel operating lever tension is the cosmetics of how the reels appear to a player looking through the window. If the speed is too slow when initially started, they will appear sluggish, and this may not be as appealing as a slightly crisper motion. Needless to say, if the motion becomes too crisp, excessive wear will be generated by most of the operating parts. Again, it is the happy medium that is sought.

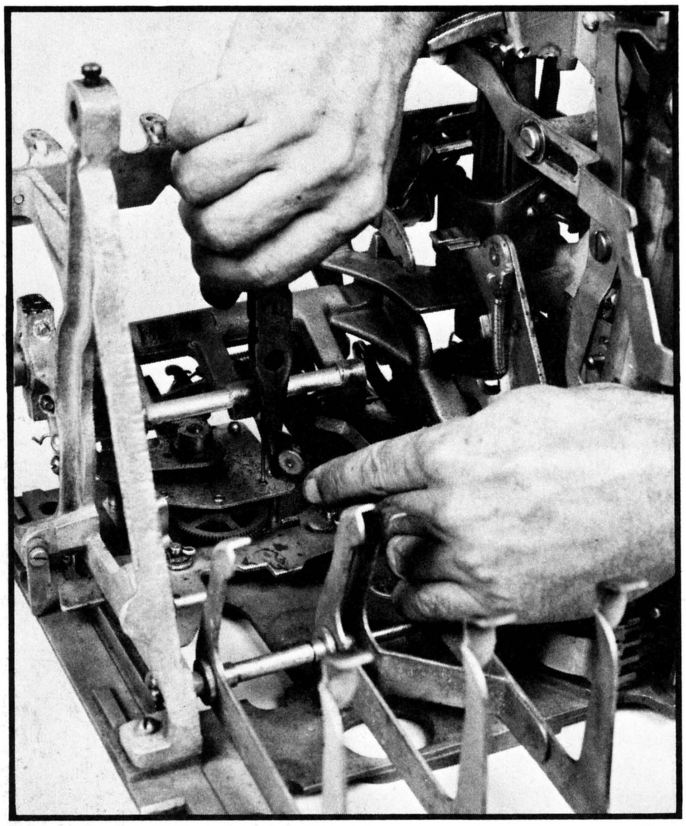


Figure 14.6

Adjusting the Clock Fan for Unwinding Timing

The clock fan is the basic controlling element which dictates the duration of the unwinding cycle. The clock may be speeded up by bending the fan blades in towards its center shaft as shown in Figure 14.6. Conversely, its speed may be slowed by bending the blades away from the center shaft.

An alternate to adjusting the clock fan in order to control the duration of the unwind cycle is to adjust the tension on the clock spring. Care must be taken, however, that the final tension is sufficient to complete the unwind cycle.

The duration of the unwind cycle should first be established by adjusting the clock fan for some nominal time, such as six seconds. For casino operations, where it is more desirable to squeeze many plays per hour for profit reasons, this cycling is usually shortened to three or four seconds. For home use, a longer cycle is desirable since it places less of a strain on the mechanism.

Ideally, once the duration of the unwind cycle has been fixed, the reel operating lever tension can be adjusted to insure adequate reel speed; then the brakes can finally be adjusted to provide the proper rate of speed at the time the reels are stopped. However, this is generally not the case, and these adjustments are usually made to compensate for sluggish reels; therefore, speeding up the unwind cycle to accommodate the reel speed is usually the rule.

It cannot be over emphasized how important it is that the reel assembly itself be clean and does not cause excessive internal drag to produce its premature slowing down. It is often the case where the only solution to the problem is to disassemble the reel assembly and clean it, as other forms of solving the problem will generally not work.

Adjusting the Reel Brakes

The adjustment of the reel brakes is described in Chapter 4.

On most older machines, the brakes have usually been removed with the explanation that they are not really important. For limited home use, this is probably not a too farfetched statement, but if brakes are present they should be used to minimize wear on the machine.

Adjusting the Pump

The pump can be adjusted by backing off the lock nut and adjusting the screw (which acts as a needle valve), as shown in Figure 14.7. The function of the pump is to provide smooth return of the handle to its ready position. If the pump is adjusted too tightly,

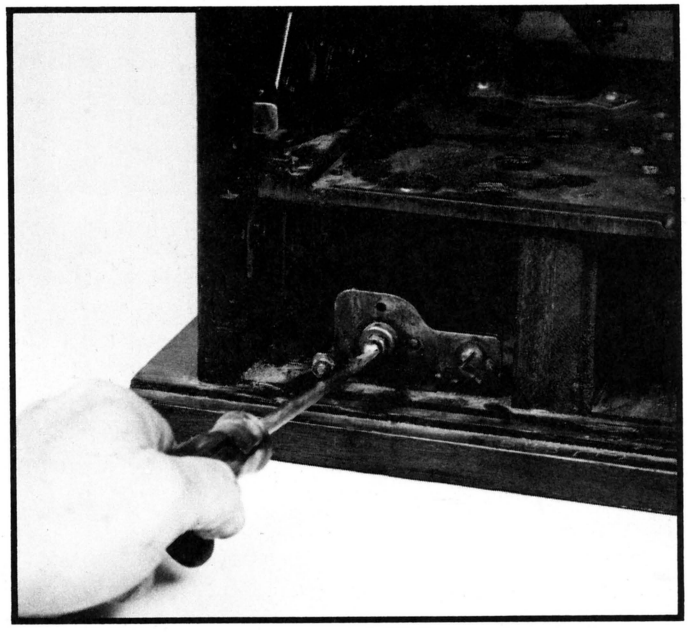


Figure 14.7

then by the time the operational cycle is completed by the mechanism, the pump will constrain the handle, and the operating levers of the machine will have to wait to be recycled. On the other hand, if the pump returns too rapidly, the handle will cause jarring and vibration on the case and general wear and tear and loosening of its bushing. A return time of one-half second is considered ideal.

Timing Lever Adjustment

The timing lever adjustment screw can be adjusted by backing off the lock nut and screwing it in or out, as shown in Figure 14.8. It is the adjustment of this screw that determines the exact time the vertical payout levers are released.

The releasing of the vertical payout levers should be made to occur approximately half way in between the time that the third reel comes to a stop and the payout slides are released. This may require a little trial and error and once the exact point of setting of the screw has been achieved, its lock nuts should be firmly tightened and again checked for possible movement.

On older machines no such adjustment screw is present, and the timing adjustment is made by bending the arm of the clock as shown in Figure 14.9. Bending the arm either up or down causes the advancing or retarding of the timing respectively. Bending the arm down retards the action and bending the arm up advances the action. An alternate to this method is to bend the linkage bar, which is connected to the clock, to the reel stop timing lever as shown in Figure 14.10.

The final phase in timing is the final step of the unwind cycle where the payout slides are released. This point in time is not adjustable with respect to reel stopping without bending the linkage connecting the clock and the reel stop timing lever. Generally speaking, the timing of the payout slides should only be

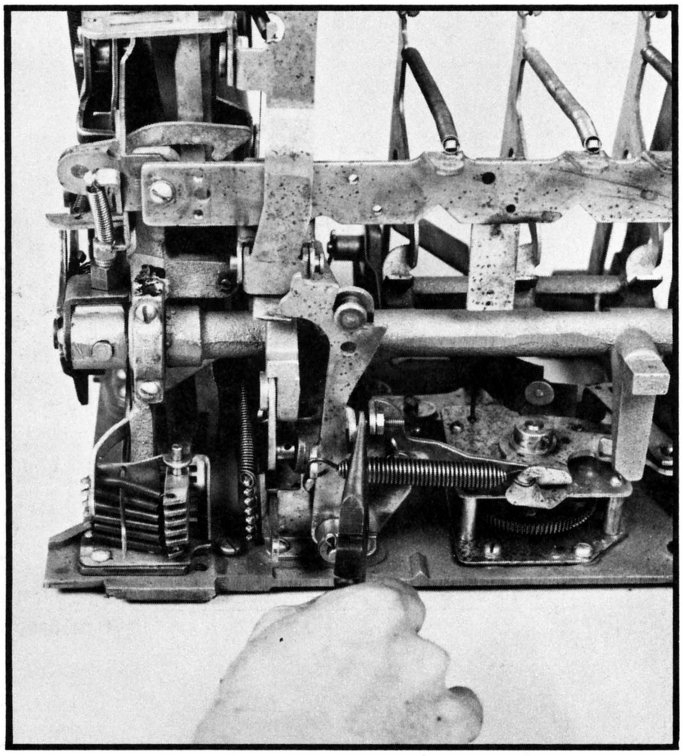


Figure 14.8

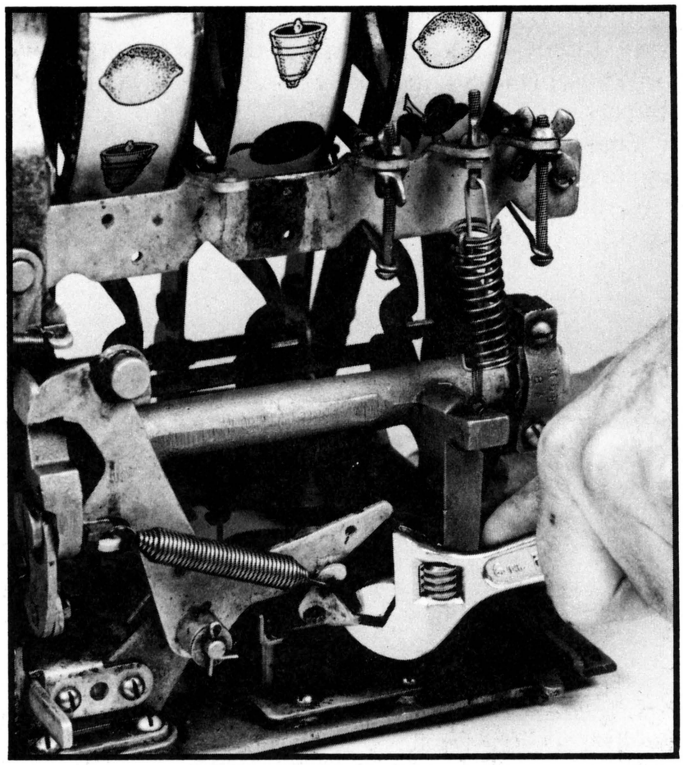


Figure 14.9

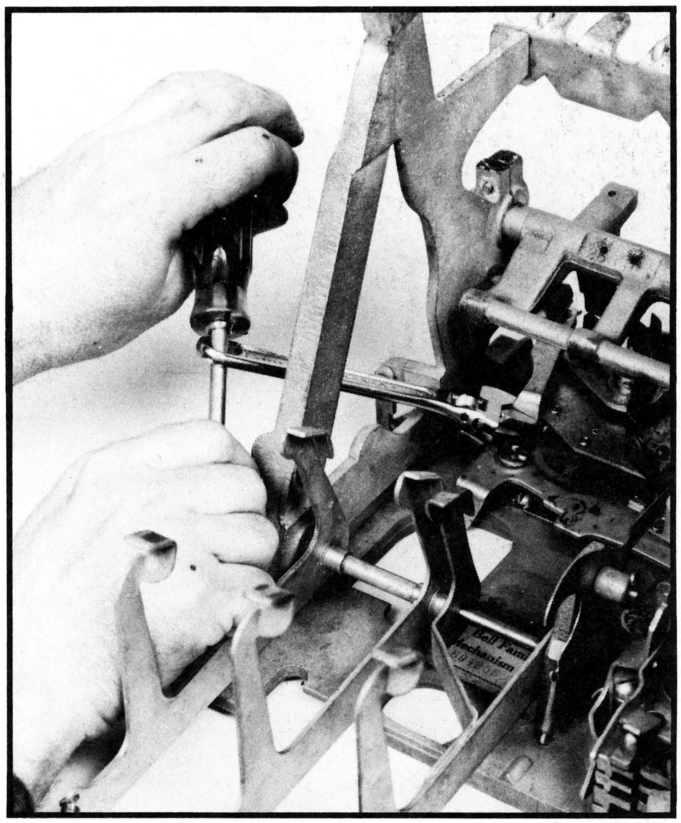


Figure 14.10

changed if there is too little time between the third reel stopping and the release of the payout slides.

When properly timed, the five machine clicks (i.e., the reels stopping, the release of the upper payout levers and the release of the slides), should be even and equally spaced. Indeed, if the fourth click (release of the vertical payout levers) is premature, the vertical payout fingers will sometimes "find" their pays, and the mathematical payout percentage of the machine is doomed.

Jackpot Adjustment

The jackpot interface can be observed and adjusted by first removing the reel assembly from the mechanism and then inserting the mechanism into the case, as shown in Figure 14.11. An alternate to this method of observation and adjusting is to remove the top half of the case and to observe from in front, looking down. This latter method is not recommended since it is more tedious than the first technique.

Once the mechanism has been inserted in the case, it can be cycled, in which case a jackpot will be achieved by each play unless the vertical payout levers are restrained—either by removing their springs or by holding them back. By observing the operation of the mechanism with and without jackpots occurring, proper operation can be established by adjusting the action of jackpot trip lever with the jackpot.

On the older style machines (see Appendix B), the

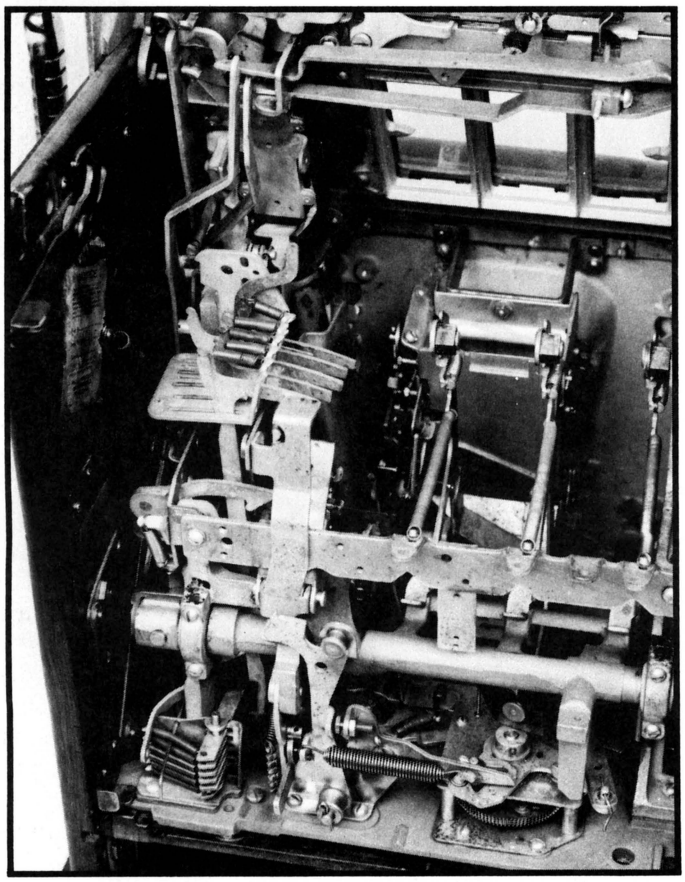


Figure 14.11

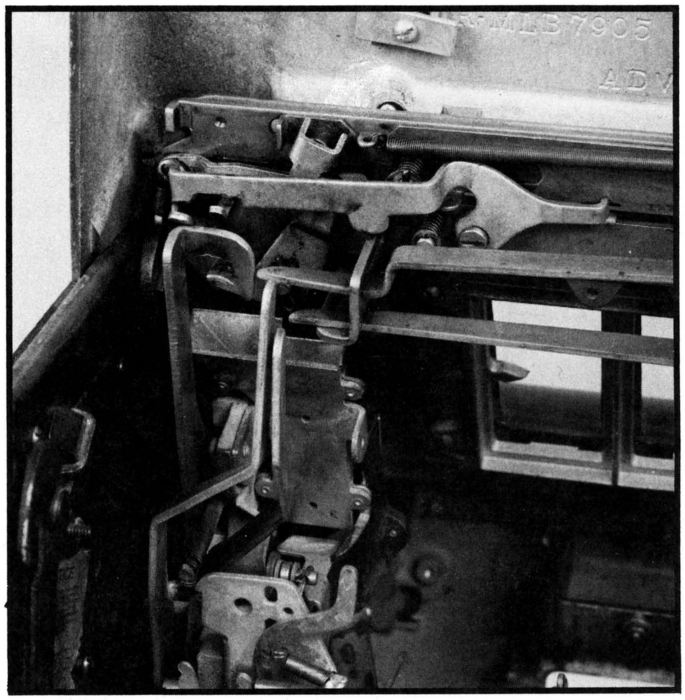


Figure 14.12

jackpot, the safety lever and the proper operation of the safety lever can be observed and adjusted by inserting the mechanism into the case with the reel assembly removed, and watching the relative sequence of the arm and disarm feature of the safety lever.

The Mechanism Escalator Adjustment

The interface between the escalator and the mechanism (the coin advance bar operating lever) is probably one of the greatest weaknesses in the general design of the Mills slot machine. This interface is re-

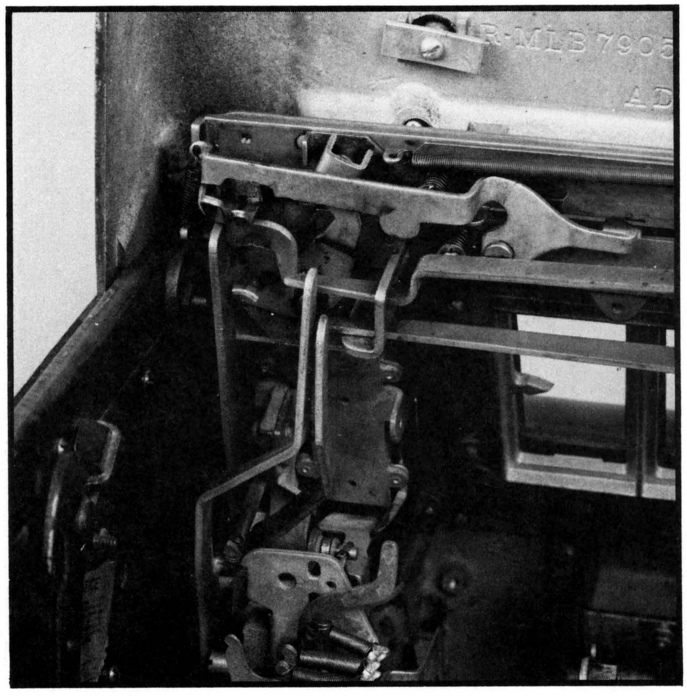


Figure 14.13

sponsible for many jamming situations and it is one of the most sensitive areas in the entire machine. Figure 14.12 shows what this interface looks like just before the machine is seated in the case. It should be noted that the various escalator levers are positioned in their reset position, and they wrap around the advance bar operating lever as shown. Once the mechanism has been placed in the case and seated, the interface appears as shown in Figure 14.13.

The adjusting and bending of this interface should allow the mechanism to freely slide into its seated position while maintaining the proper interface after the mechanism has been seated in the case. There is no simple way to explain how to adjust this interface, other than by presenting these pictures of one which has been properly adjusted.

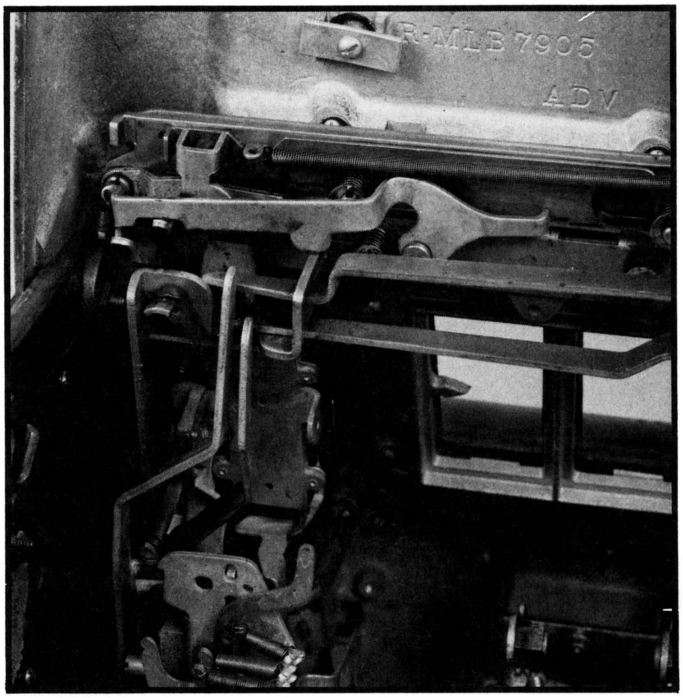


Figure 14.14

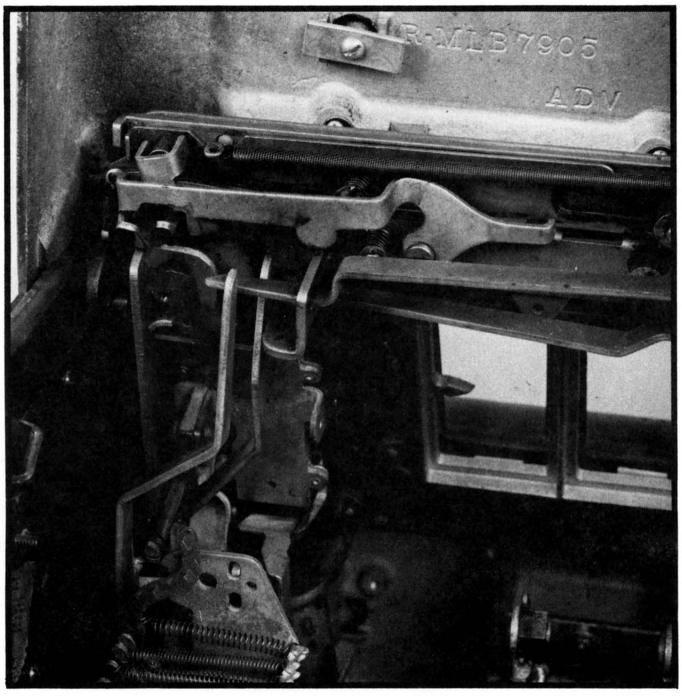


Figure 14.15

Figure 14.14 shows this interface when the mechanism is half way into the wind-up cycle. Figure 14.15 shows this interface after the wind-up cycle has been completed, and the release cycle has been started. When the unwind cycle has been completed, the interface is returned to the state shown in Figure 14.13.

If the coin advance bar operating lever fails to return to its upward position, or if the coin advance bar operating lever fails to return to its reset position upon the completion of its cycle, there is binding at the interface, and each lever should be examined to see where the rubbing or friction is occurring. As mentioned previously, it is possible that there is not enough tension on the main operating lever spring on the mechanism to provide sufficient upward motion of the coin advance bar operating lever.

Another problem that can also cause jamming in the interface, especially when the machine has been restored, is the relative positioning of the mechanism with respect to the case. The escalator is attached to the case, and the mechanism is attached to an adjustable base plate which is held to the case by the four mounting bolts. There is some latitude of the relative positioning of the mechanism in the case, and therefore with respect to the escalator. It is important to make certain that the mechanism is positioned correctly in the case with respect to the escalator. It may be necessary to leave the four base mounting bolts loose in order to position the mechanism in the case to get the correct placement. Don't forget that each time the base is moved, the jackpot interface should be checked. It cannot be over emphasized how important smooth operation of the escalator interface is to smooth and clean operation of the machine.

Springs

As mentioned previously, springs are prone to lose their tension over the years or fail completely. In general, the springs used in slot machines are special purpose springs of very fine wire and are not usually found in hardware stores. Fortunately there are several sources advertising in the trade magazines with the springs which are suited for the Mills slot machines, and it is highly recommended that an assortment of these springs be used rather than to attempt to "make do" with some near-fitting spring. When putting springs on the mechanism, it is important to cycle the mechanism with these springs, to make certain they have been fastened correctly at both ends and will not pop off. One major cause of malfunctions in the machine is for a spring to break loose at one of its ends and thereby cause the mechanism to become inoperative.

Springs should be lightly coated with oil to prevent

rusting. Rust, actually an oxidation of the surface, causes microscopic pits which, in turn, cause stress concentrations. These stress concentrations are a major source of spring failure.

Bending

Several examples of bending have been given in the sections of interfaces and timing. Another part which occasionally needs bending is the vertical payout lever pushback lever. The need to bend this lever occurs when the vertical levers are not pushed far enough away from the discs while they are spinning.

While bending may seem a crude way to adjust the mechanism, it is the only practiced and practical method. Remember, most parts in a slot machine were produced by bending—formed by a punch press—and so bending for proper adjustment is only a final step in the manufacture of the parts.

Bending should only be done, however, as a last resort. Make certain that there is no simple alternative before bending any part, since bending does produce metal fatigue.

APPENDICES

A

Reel Operating Lever Assembly

The reel operating lever on earlier Mills machines is shown in Figure A.1. Note that the main difference is its yoke which allows the operating fork to supply it energy when it engages the reel discs. Figure A.2 shows the reel operating lever and its interaction with the main operating fork. The addition of the adjustable tension spring shown in Figure A.3 supplies tension to the fork which is transmitted to the reel operating lever during the release cycle of the mechanism.

In Figure A.4 note the absence of any adjustment on the rear timing lever. The main arm of the clock must be bent to change its timing as explained in Chapter 14. As the main operating fork goes through its wind-up cycle, the disc stop lever is retracted by a protruding portion of the fork as shown in Figure A.5. As the clock unwinds, the rear timing lever presses against the lower portion of the disc stop lever, causing it to swivel and free itself from the operating fork as shown in Figure A.6. This action assures the proper placement of the disc stop lever with respect to the operating fork during the mechanism's cycle.

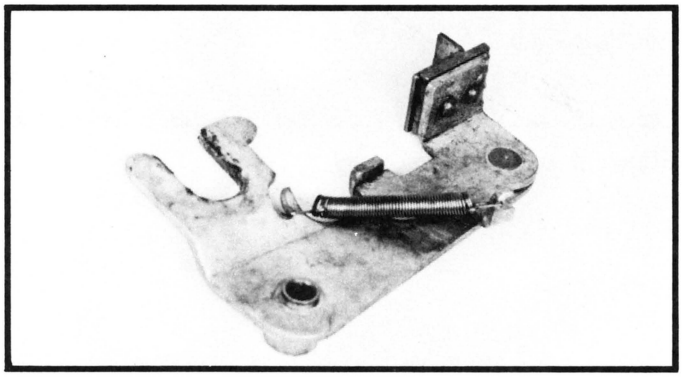


Figure A.1

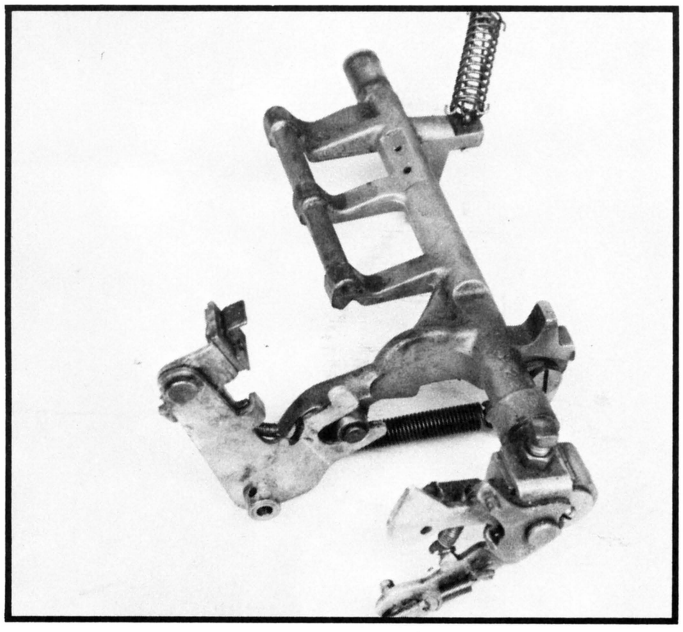


Figure A.2

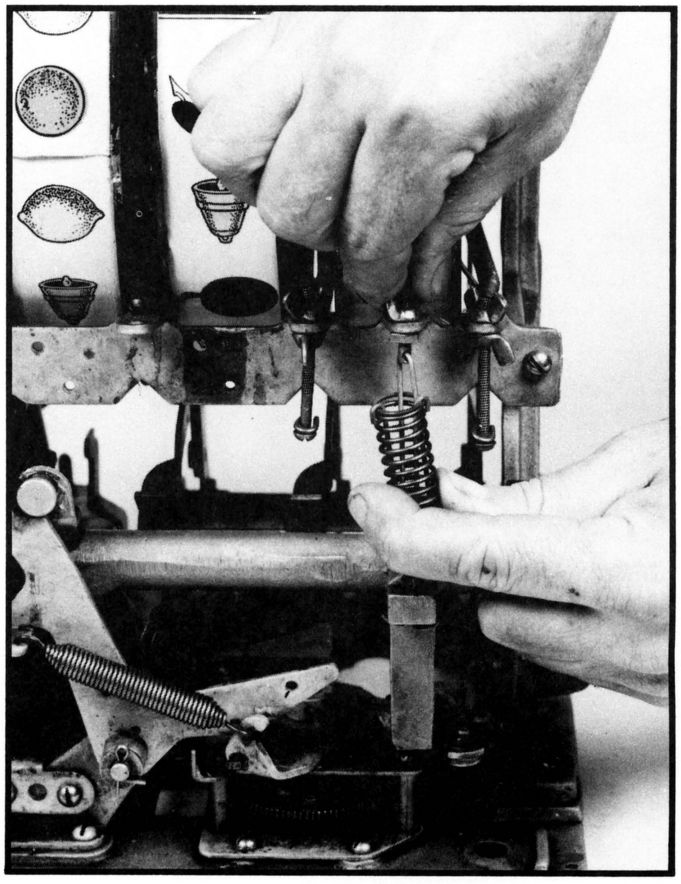


Figure A.3

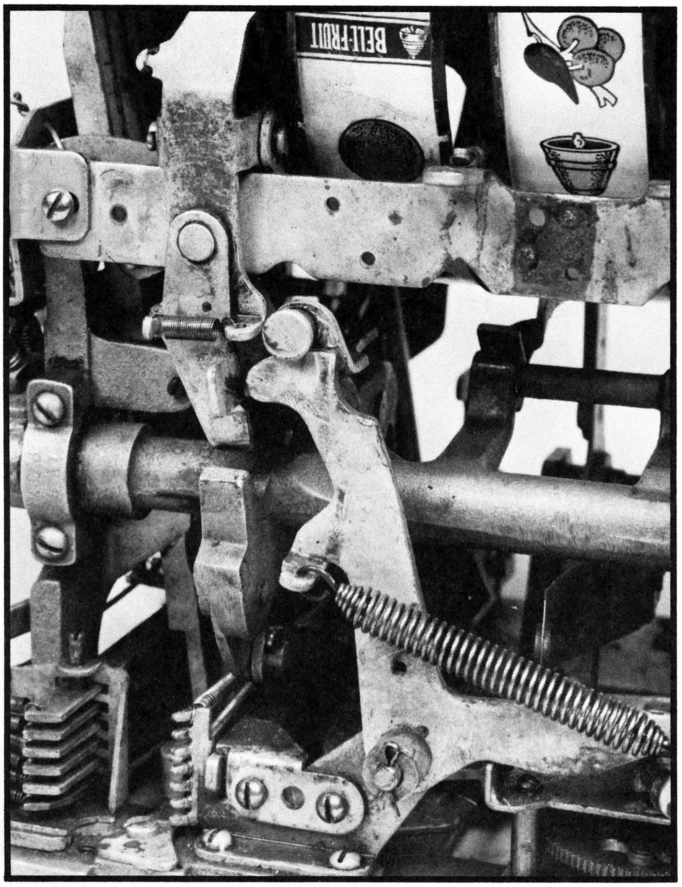


Figure A.4

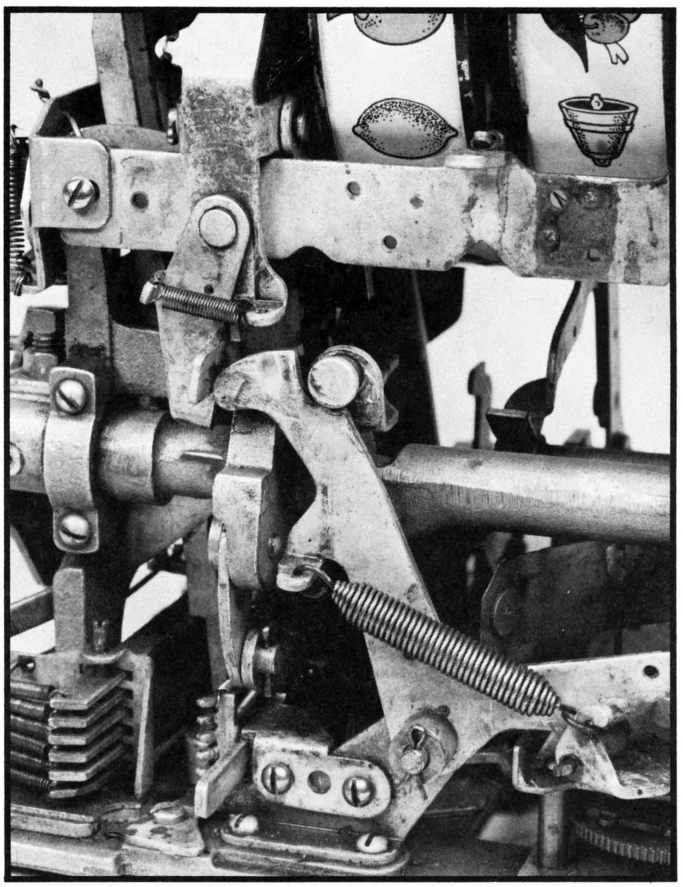


Figure A.6

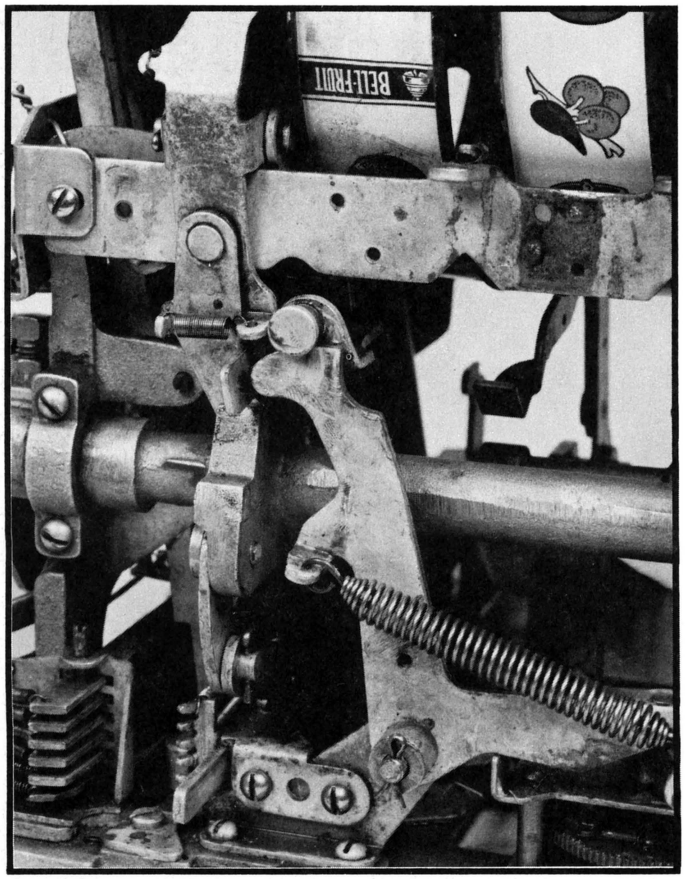


Figure A.5

B

Jackpot Assembly, Early Escalator-Style Machines

The jackpots used on earlier escalator-style machines employed a safety release lever, shown in Figure B.1, Arrow A, and an interlocking trip mechanism, shown in Figure B.1, Arrow B, which were discontinued on later models. Figures B.2, B.3 and B. 4 show the trip lever on this style jackpot interfacing with the jackpot slide. Notice that the prong at the end of this jackpot slide is larger than the one on the jackpot slide used in the main body of this book because of the method to trip the jackpot.

When the mechanism is inserted into the case, the prong on the jackpot slide will trip the jackpot, but the door will not open because of the position of the

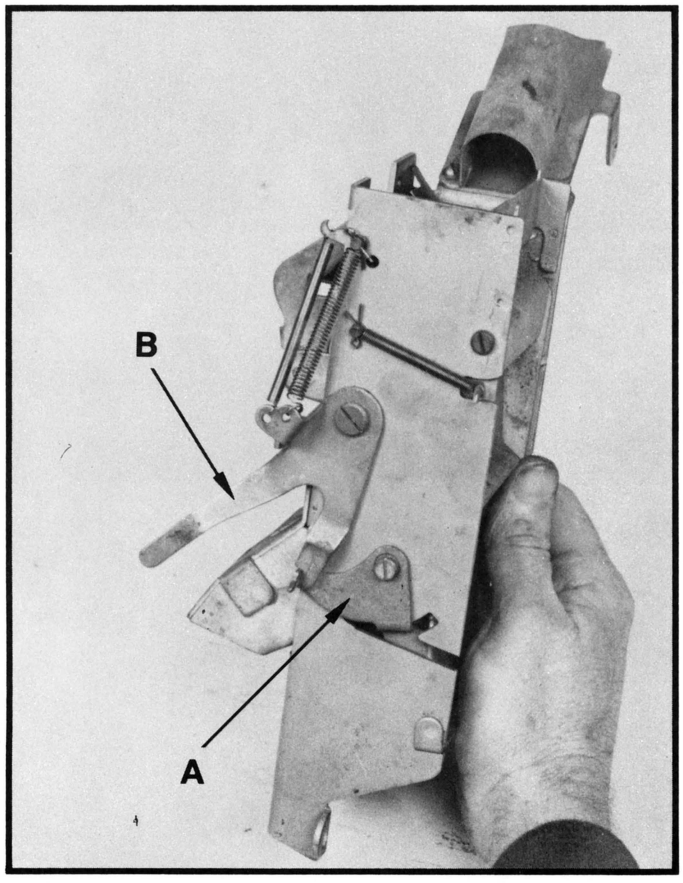


Figure B.1

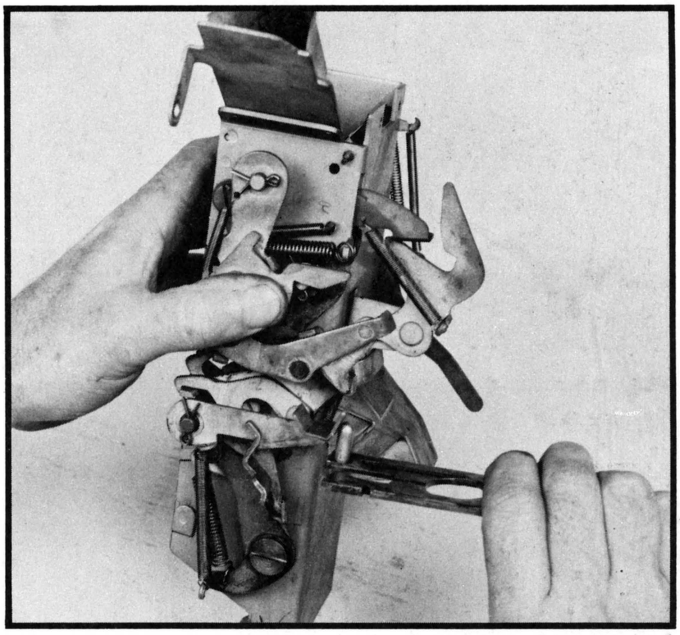


Figure B.2

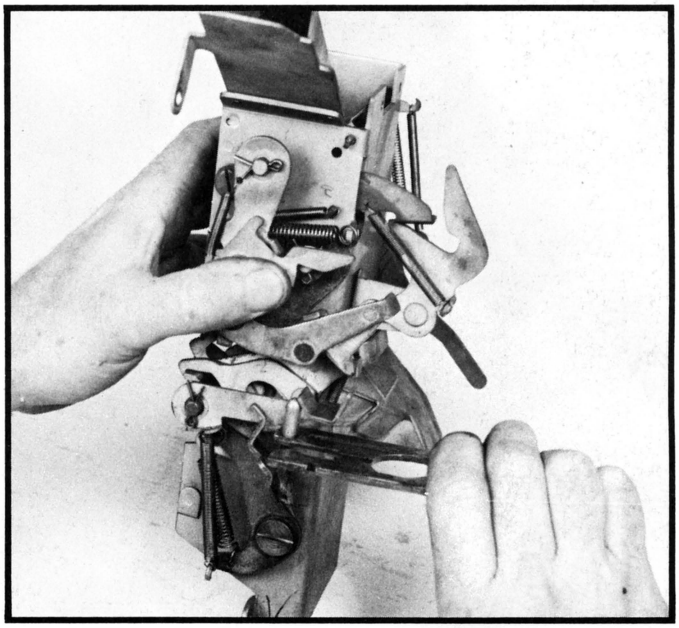


Figure B.3

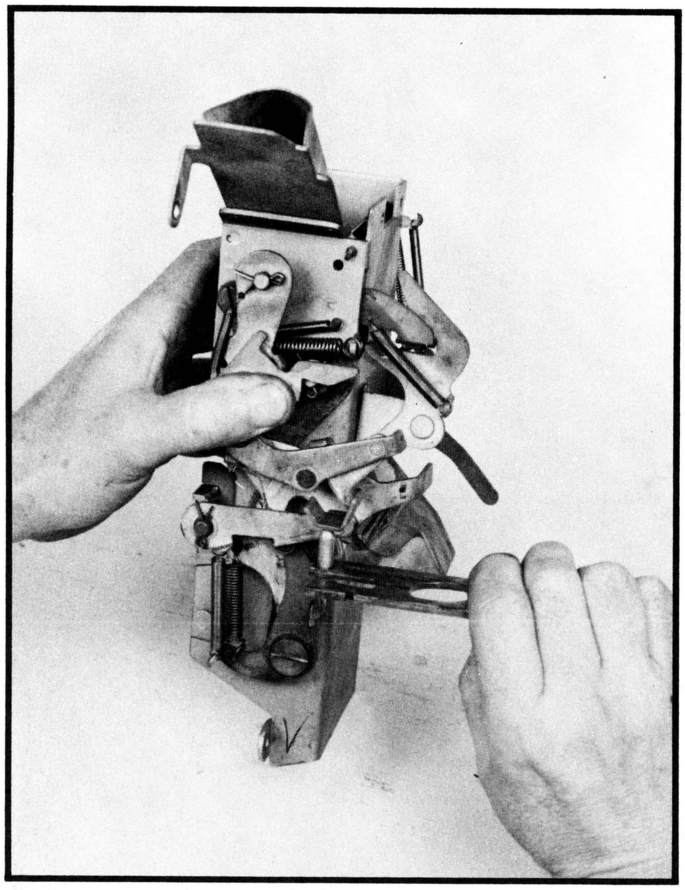


Figure B.4

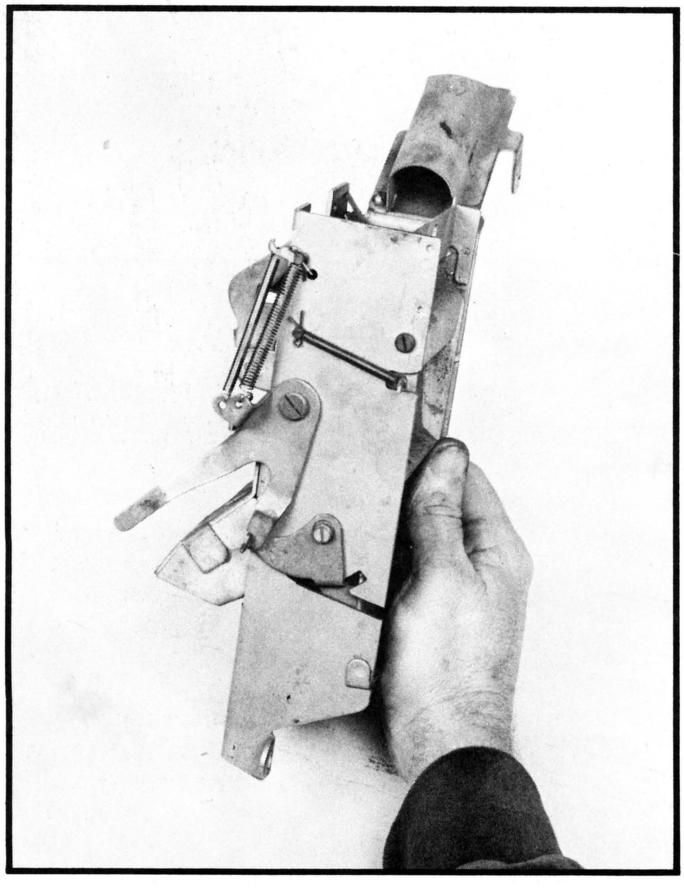


Figure B.5

safety lever which is shown in Figure B.5. After the mechanism has been sufficiently placed in the case such that the jackpot prong has slid past the trip lever, the front of the mechanism comes into contact with the jackpot safety lever and allows it to be "armed" as simulated and shown in Figure B.6. This sequence is best understood by removing the reel assembly and inserting the mechanism into the case while watching for the above described events to occur.

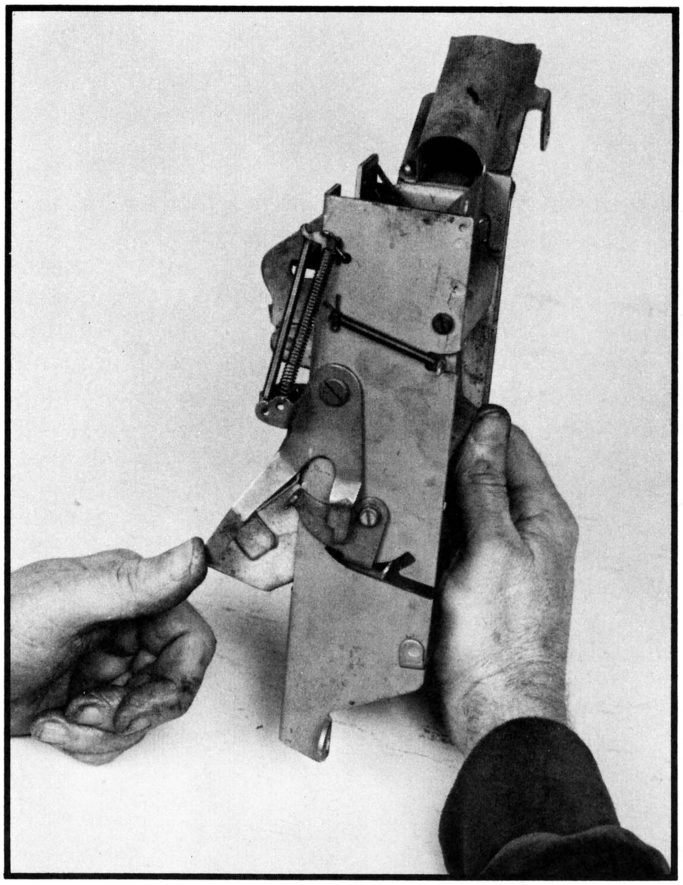


Figure B.6

C

Gooseneck-Style Machines

Introduction

The gooseneck mechanism was the primary coin entry and acceptance device used on the Mills bell slot machines until the introduction of the escalator in 1931. Figure C.1 shows a late model gooseneck machine which has been selected for the many features that it incorporates. While the gooseneck is often thought of as a relatively primitive device, its sophistication equaled that of the more modern escalator with its only disadvantage being the reduced number of previously played coins that were visible.

Unlike the later model Mills machines, there are several additional steps required to remove the machine from the case. First, the two recessed screws on the top of the front of the gooseneck must be removed as shown in Figure C.2. Second, the bolt or wing nut under the plate at the rear of the gooseneck must also be removed and the plate lifted upward as shown in Figure C.3. The machine is then extracted from the case in a manner similar to the later models.

Figure C.1

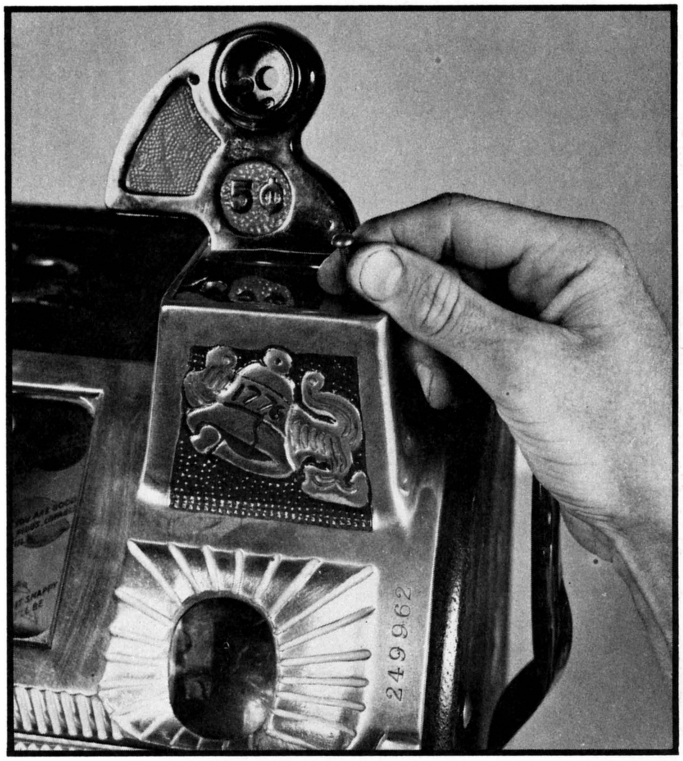


Figure C.2

Figures C.4, C.5, C.6 and C.7 show the four sides of the gooseneck after the mechanism has been removed from the case, and the reel assembly has been removed from the mechanism for better visibility.

This particular gooseneck performs many different functions and represents the most complex gooseneck that Mills made. Other and earlier goosenecks are basically the same as this configuration, but have less features depending upon the various requirements of the machine. The functions performed by this goose-

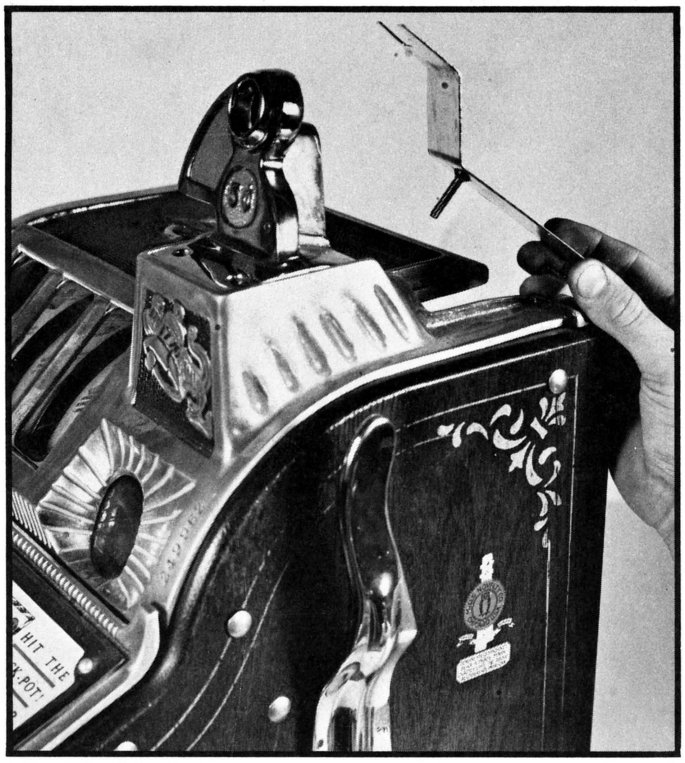


Figure C.3

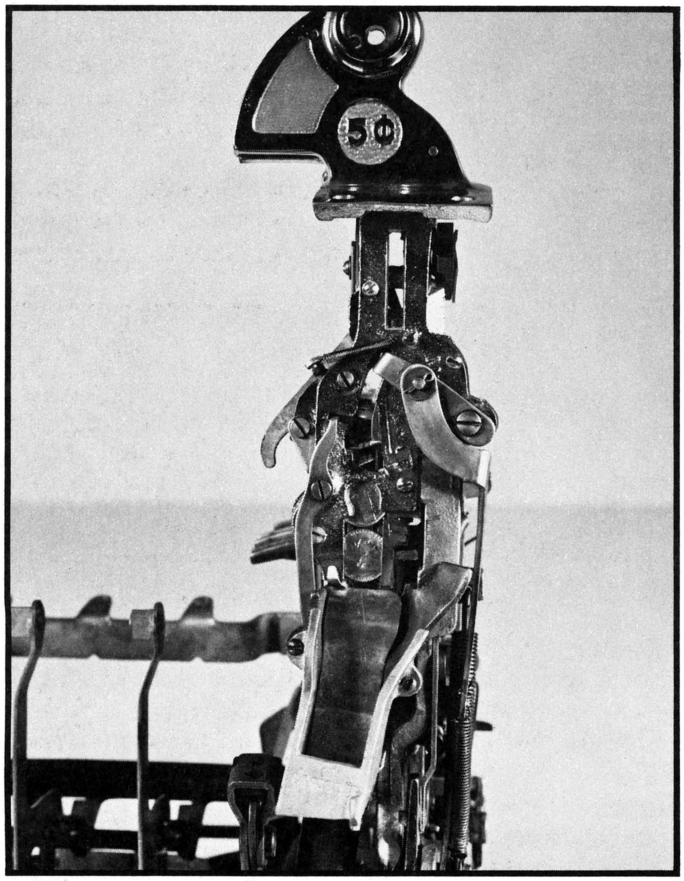


Figure C.4

neck are free-play control, vendor monitoring, coin detection and acceptance, slug rejection, check detection, coin/check separation, anti-abuse prevention and anti-cheat operation. Each of the functions will be explained below with appropriate figures to illustrate the gooseneck's operation.

Free Play Operation

On some of the earlier ten-stop slot machines, the first reel had a *Free Play* printed over one of the lem-

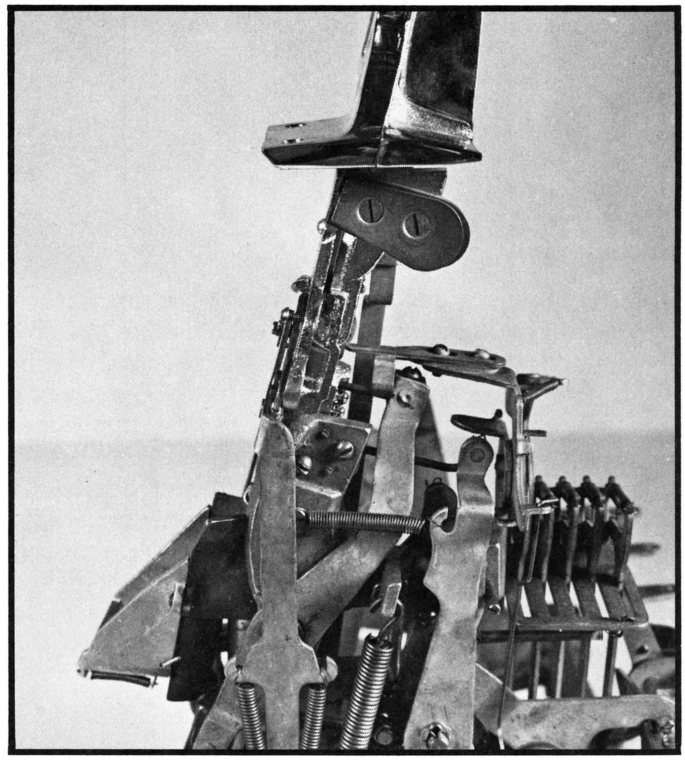


Figure C.5

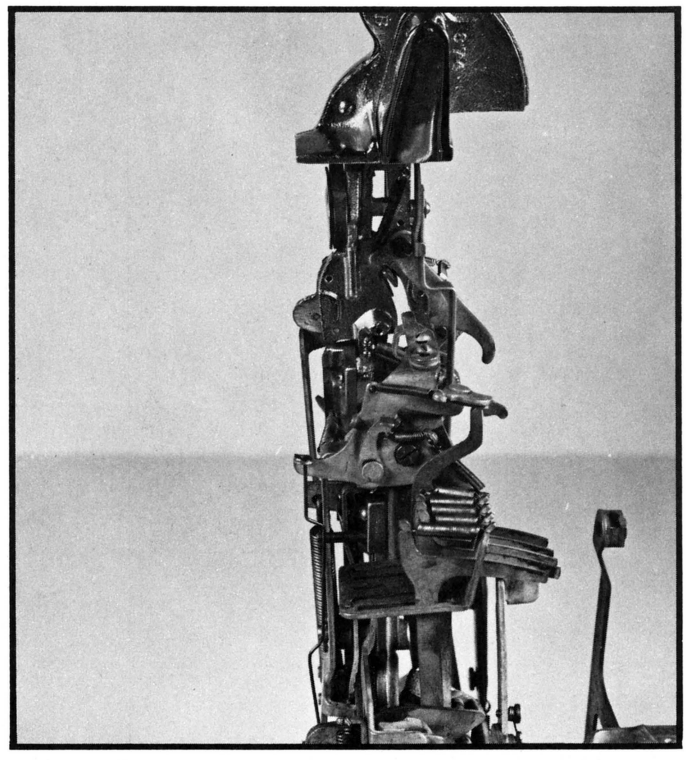


Figure C.6

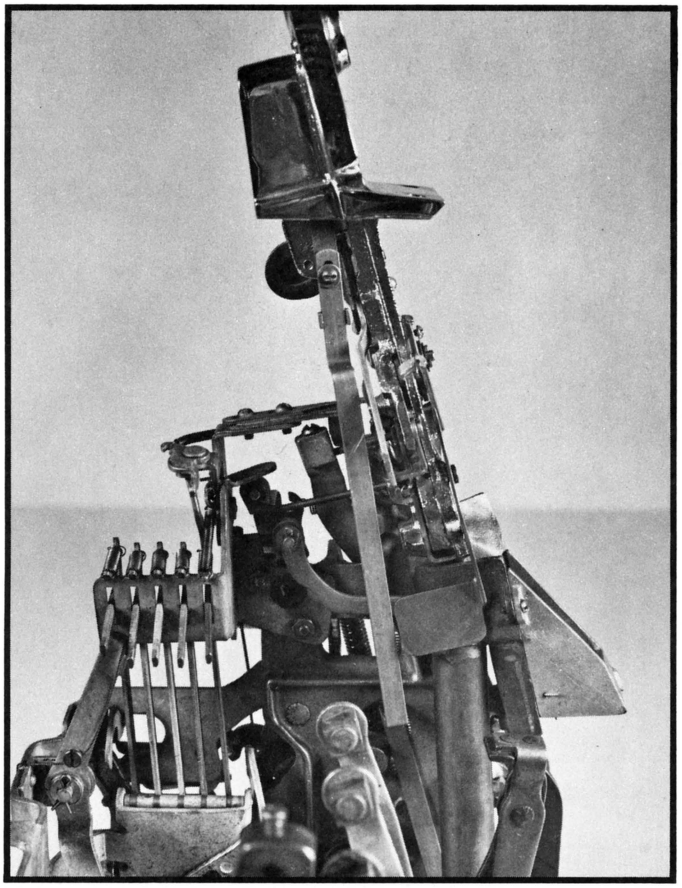


Figure C.7

Figure C.8

ons as shown in Figure C.8. It is the purpose of this feature to increase the odds of the machine approximately five percent in favor of the player.

The first reel disk has an elongated hole punched in it as shown in Figure C.9. This hole is sensed by the

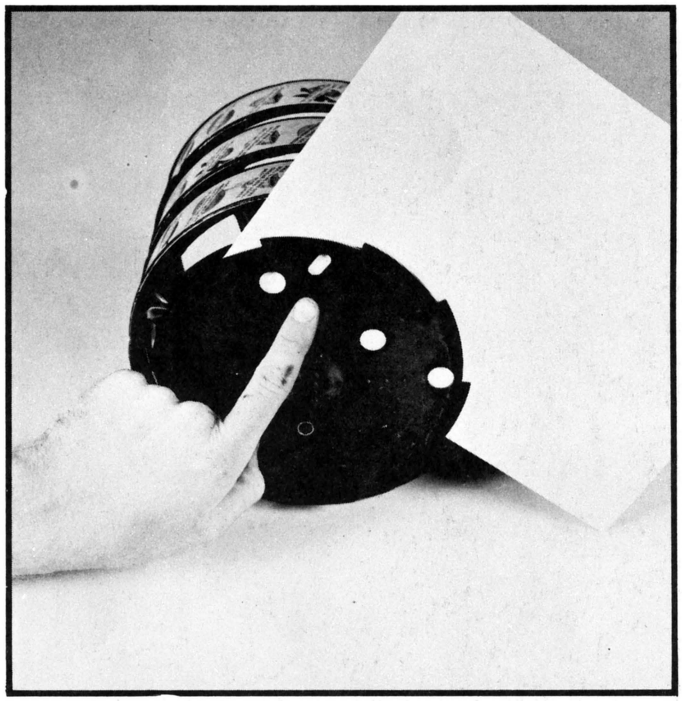


Figure C.9

free-play attachment on the gooseneck. When the free-play hole is opposite the free-play prong, as shown in Figures C.10 and C.11 the free-play assembly will rotate into the hole and thereby constrain the travel of the coin detector pin and thus simulates the presence of a coin (such a situation was tantamount to a free-play). When the free-play hole is not present, play continues as normal.

Figure C.12 shows the removal of the slug rejection box. This will provide better visibility of the free-play operation. It should be noted that one of the screws

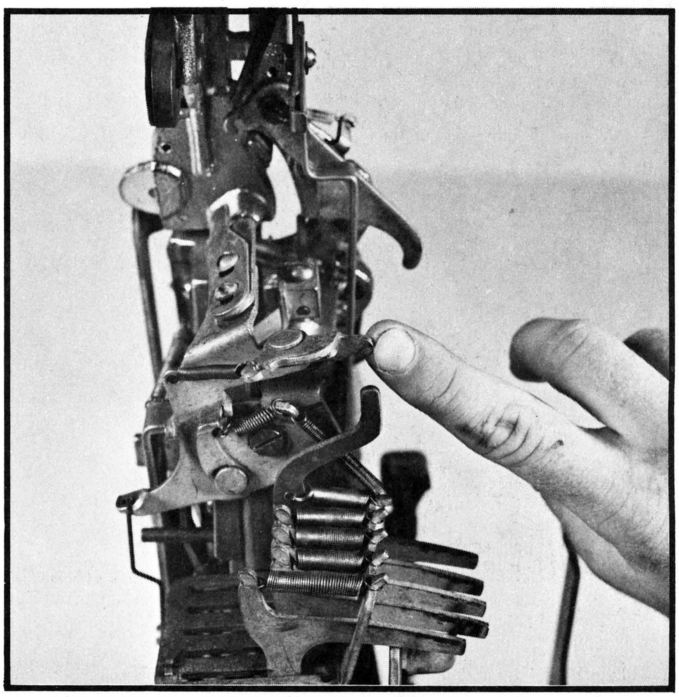


Figure C.10

holding this box is also needed to hold the gooseneck together.

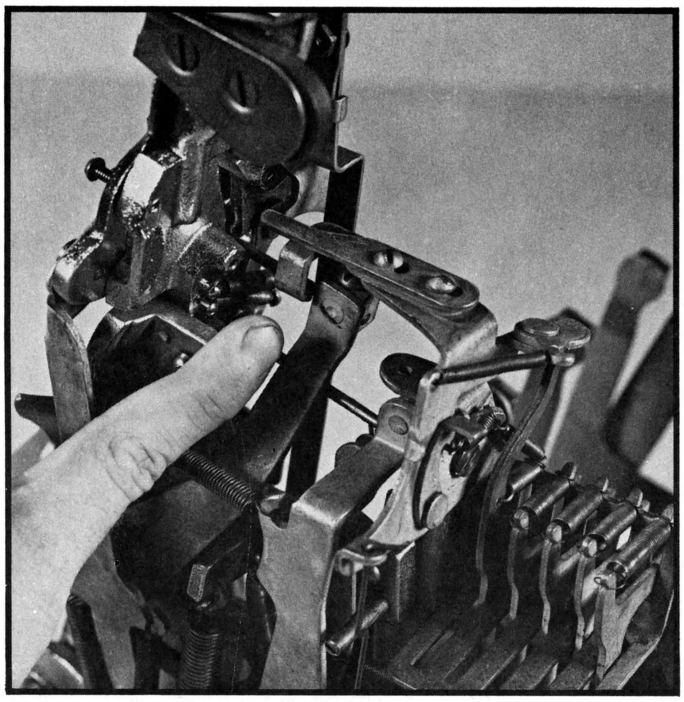


Figure C.11

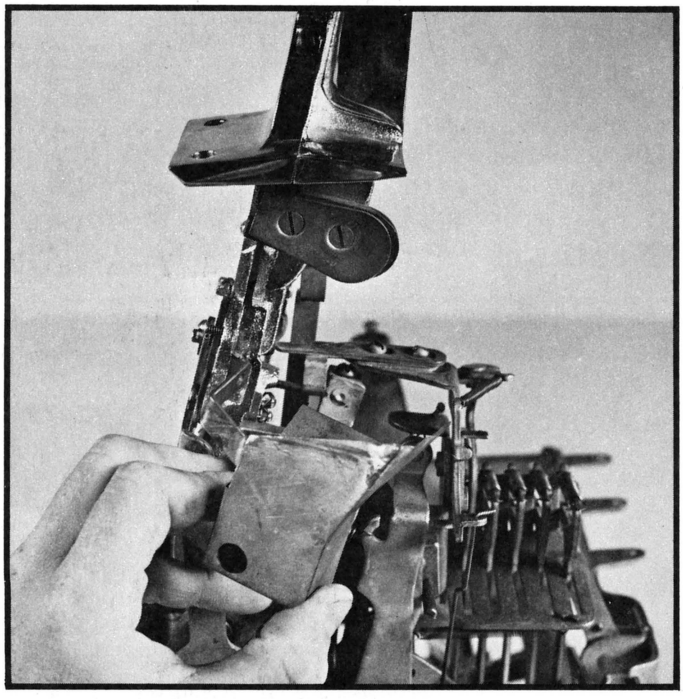


Figure C.12

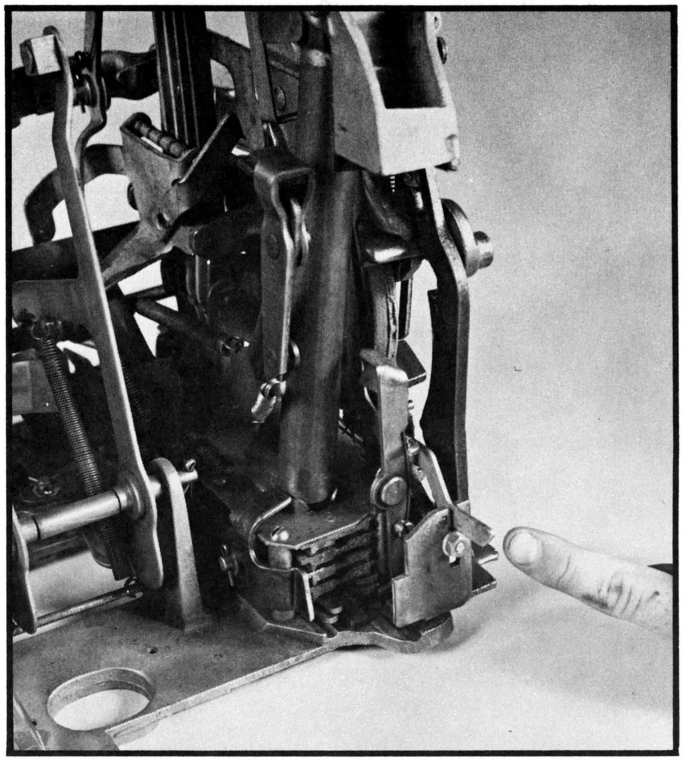


Figure C.13

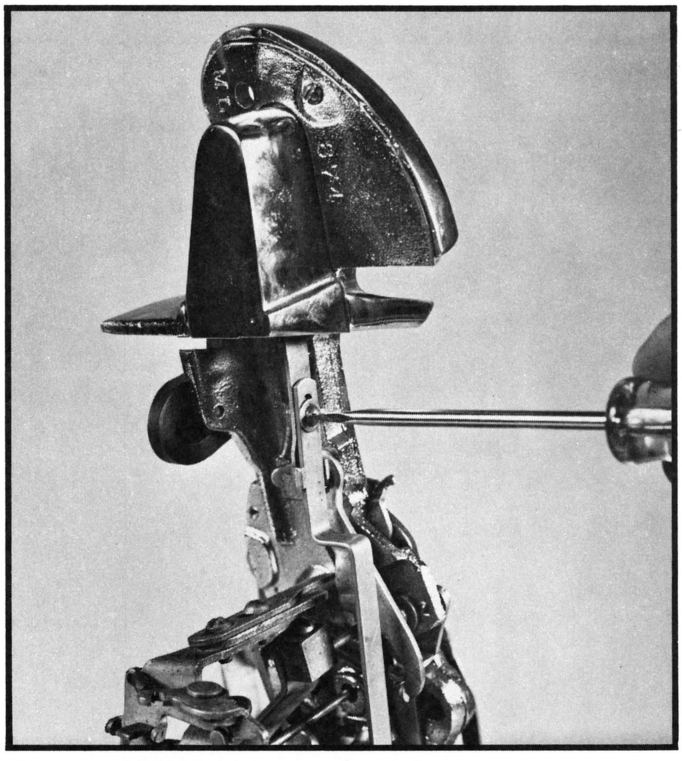


Figure C.14

Vendor Monitoring

When there are no mints left in the vendor, this condition is signaled to the mechanism via the sensing lever shown in Figure C.13. The motion of this detector lever is transmitted to the coin entrance via the bar shown at the tip of the screwdriver in Figure C.14. Motion of this bar prevents any coin from entering the gooseneck, and the attempted play of a coin will result in the coin being returned to the player out the left-hand side of the upper portion of the gooseneck.

Gooseneck Operation During Standard Coin Play

Figure C.15 shows an empty gooseneck with a coin being inserted. After passing slug rejection (to be

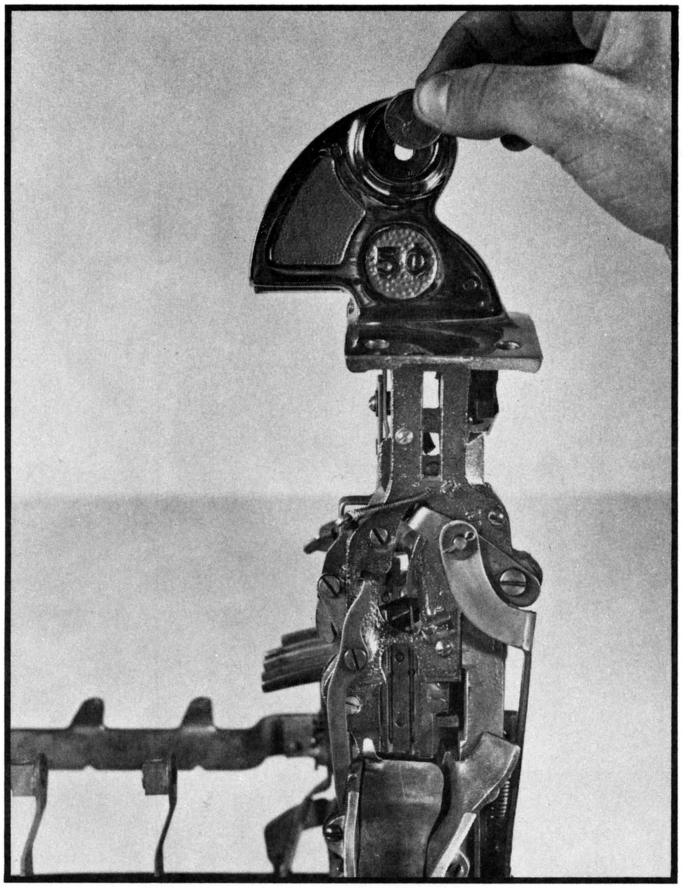


Figure C.15

explained later) the coin comes to rest in the cradle position as shown in Figure C.16. As the machine enters it's wind-up cycle, the coin is forced downward

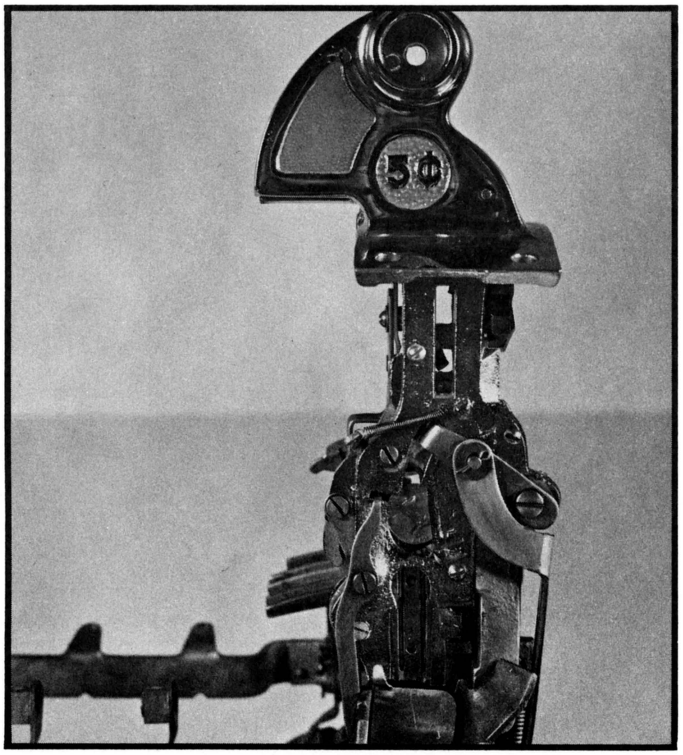


Figure C.16

by the coin advance bar lever as shown in Figure C.17, where it remains during the unwind cycle. The unwind cycle also restores the advance lever to its initial position as shown in Figure C.18.

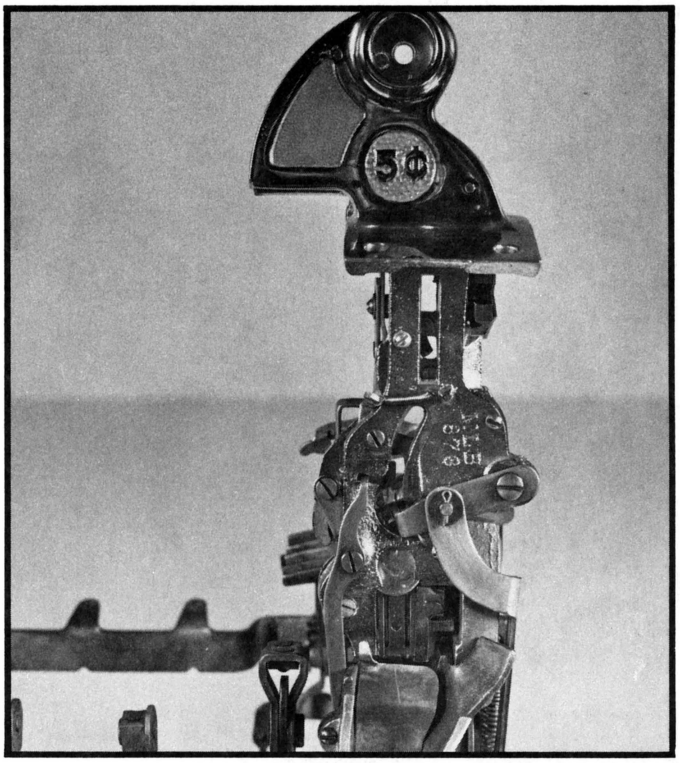


Figure C.17

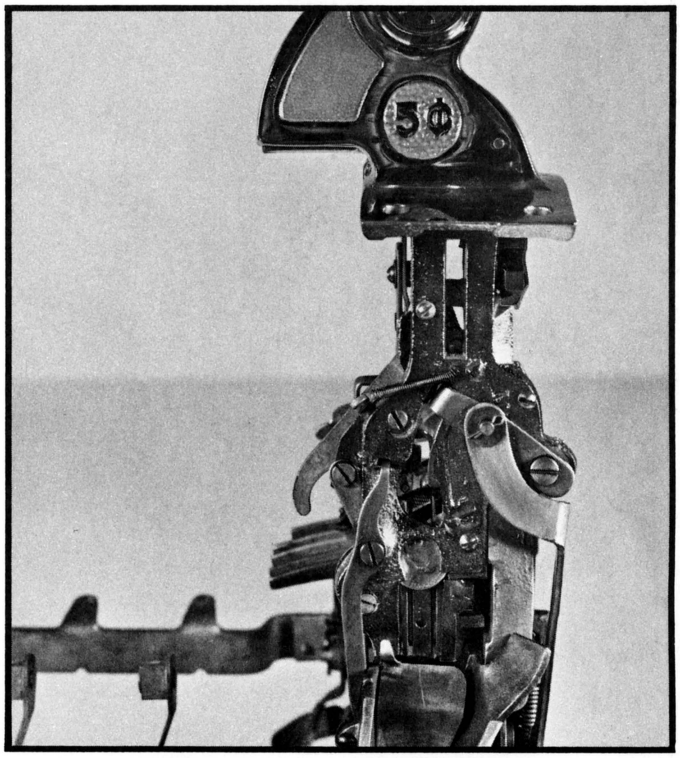


Figure C.18

When a second coin is inserted, the process is repeated as shown by Figures C.19, C.20, C.21 and C.22. It should be noted that the original coin is dis-

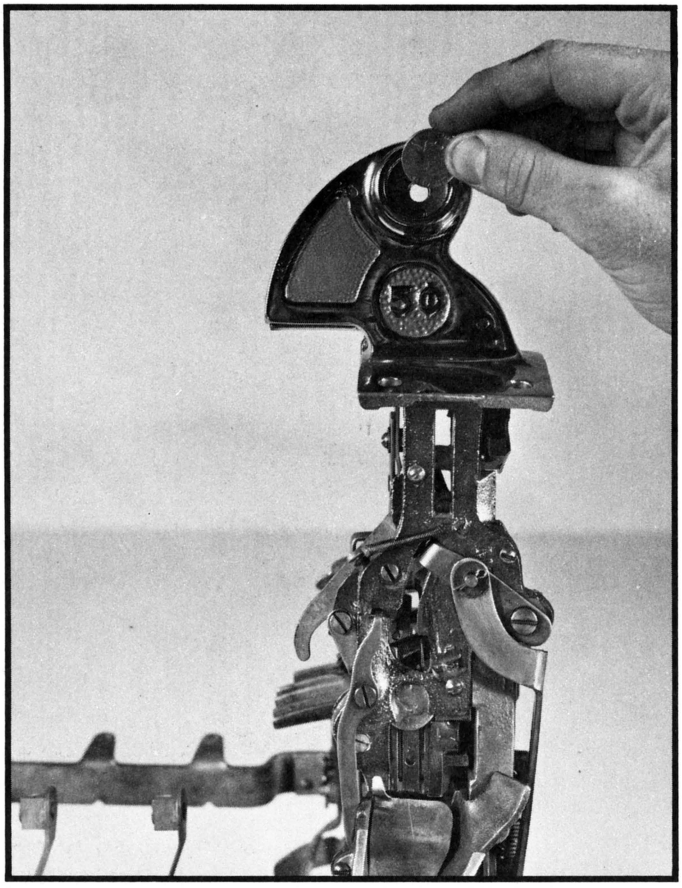


Figure C.19

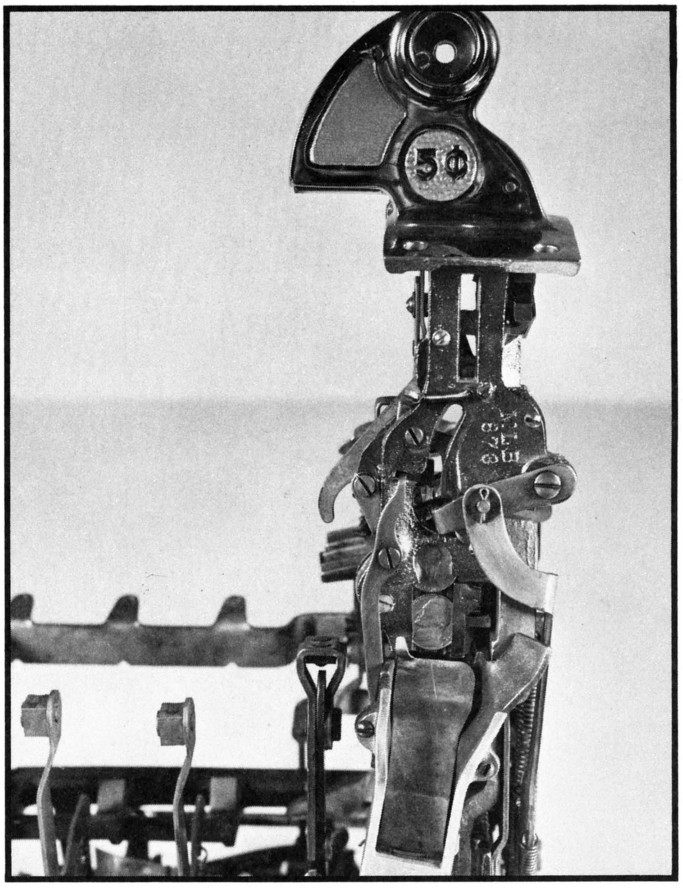


Figure C.21

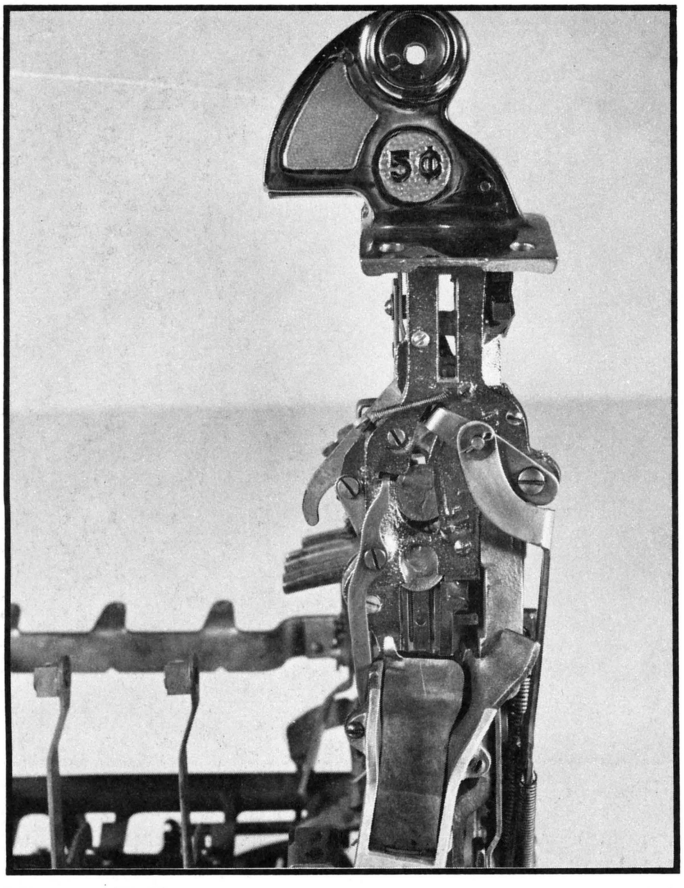


Figure C.20

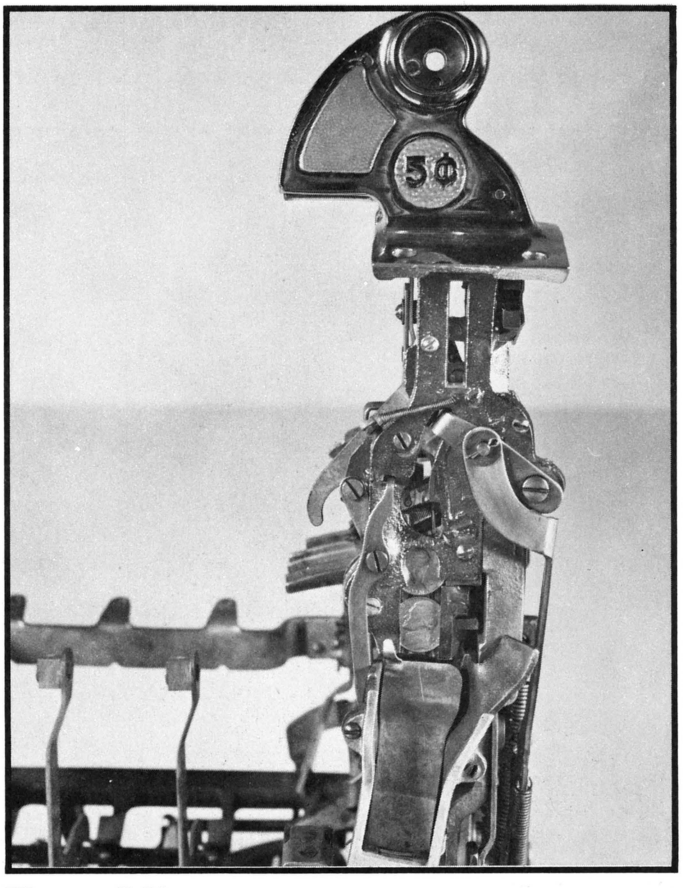


Figure C.22

placed downward with the second coin now resting on top of it in the position previously occupied by the first coin.

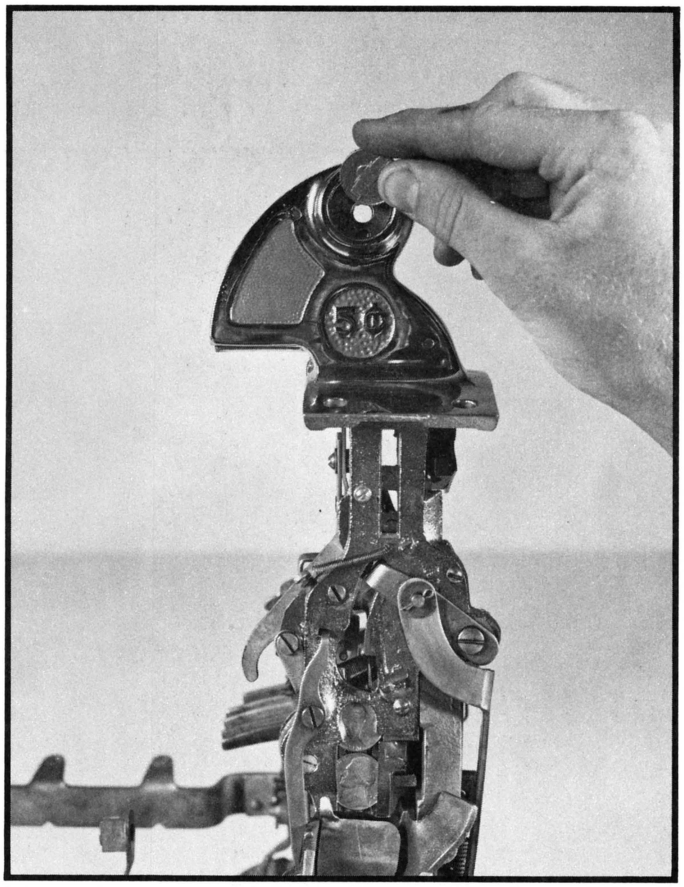


Figure C.23

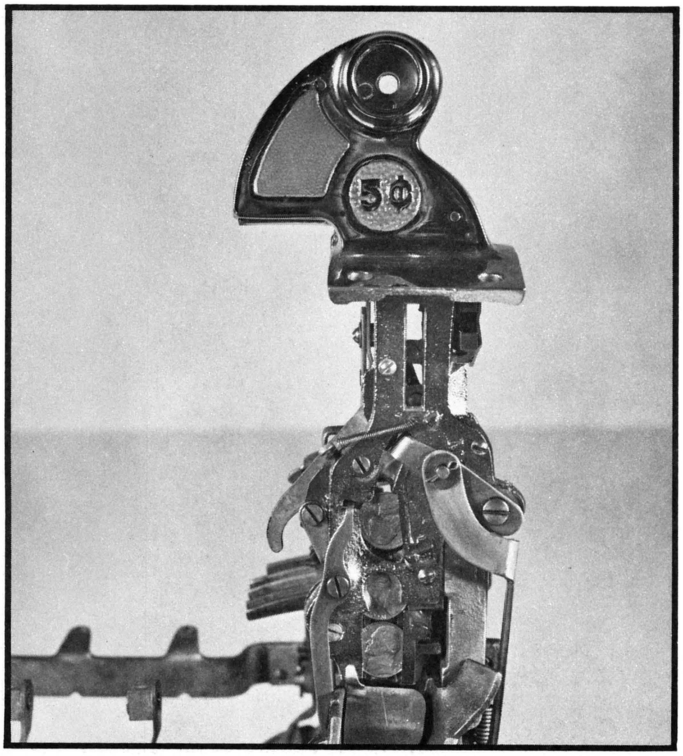


Figure C.24

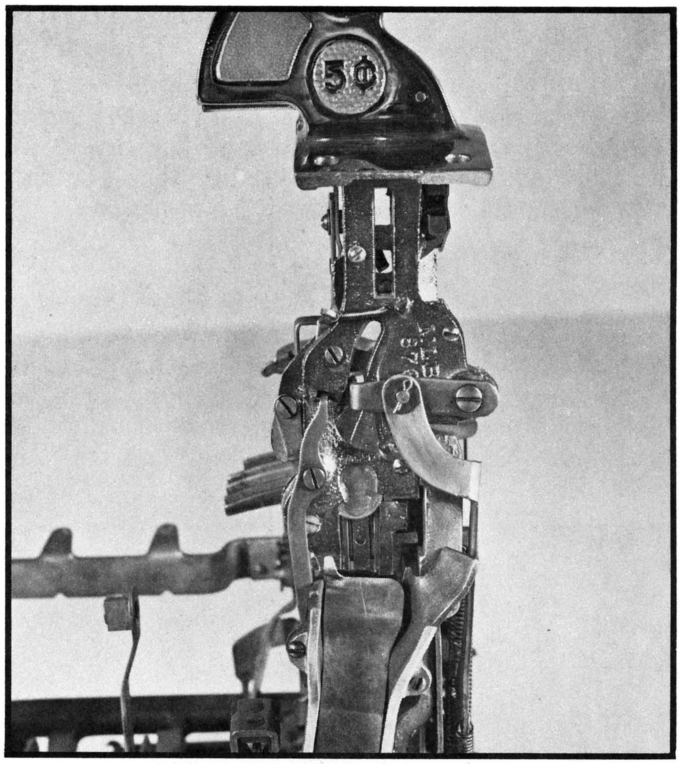


Figure C.25

When the third coin is played, as shown in Figures C.23, C.24 and C.25, the same process is repeated, but now the first coin is released downward into the

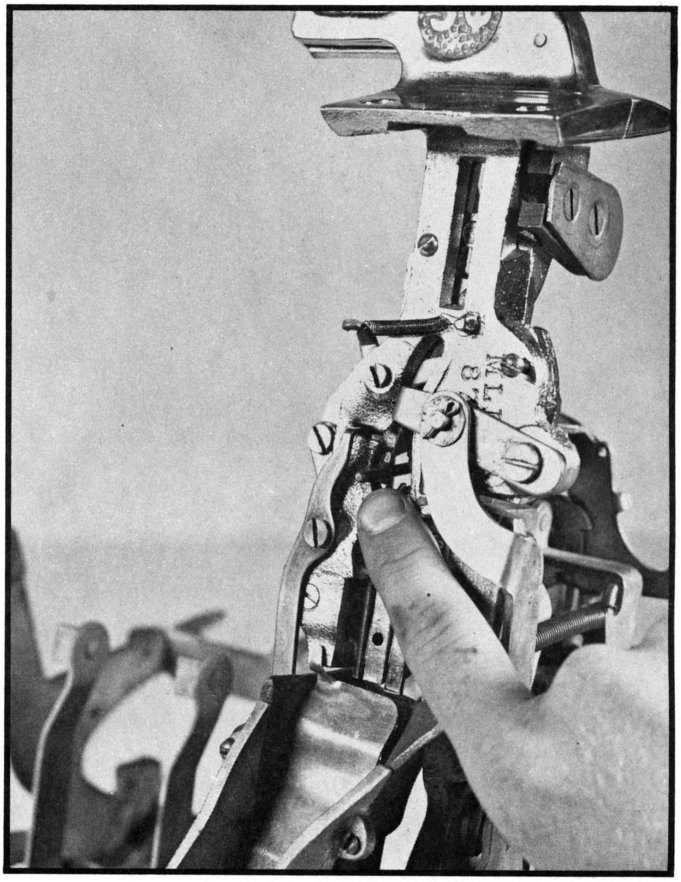


Figure C.26

mechanism with only the second and third coins remaining in the gooseneck.

The above sequence of events is the same whether coins or checks are being played and wheather or not coin/check separation is occurring. The details of these two additional types of operations will be discussed in the following sections of this appendix.

Coin Detection

The method whereby coin detection is performed is shown in Figure C.26; this photo shows the coin sensing pin probing through the gooseneck coin chute. If a coin were present, it's forward motion would be inhibited; thereby allowing the machine to be cycled as explained in an earlier section of this manual.

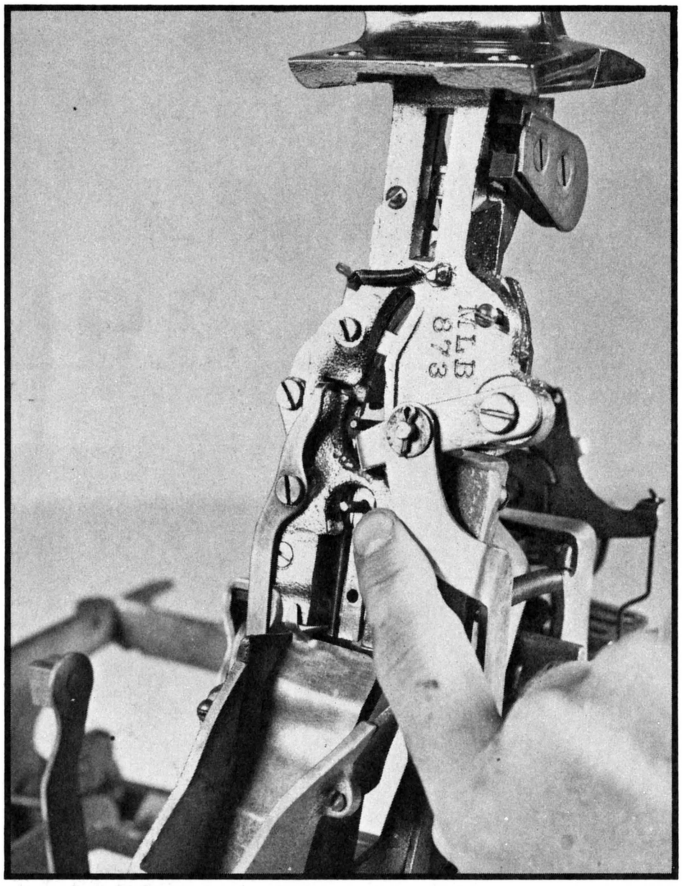


Figure C.27

Check Detection

Check detection is performed immediately after coin (check) detection by the check sensing pin, as shown in Figure C.27. If a check was played, the sensing pin would pass through the center hole of the check, thus signaling to the mechanism that a check was played.

Depending upon the machine and the way the mechanism is configured, several options are available. For a vendor machine, release of confectionery merchandise is inhibited and, depending upon operation option, machine payment may be inhibited.

Coin/Check Separation

After the machine has been cycled, the coin or check which has been responsible for its operation is forced downward into the machine. At this point, coin/check separation may be accomplished by activating the separating pin as shown in Figure C.28. This pin, if present, attempts to push the coin or

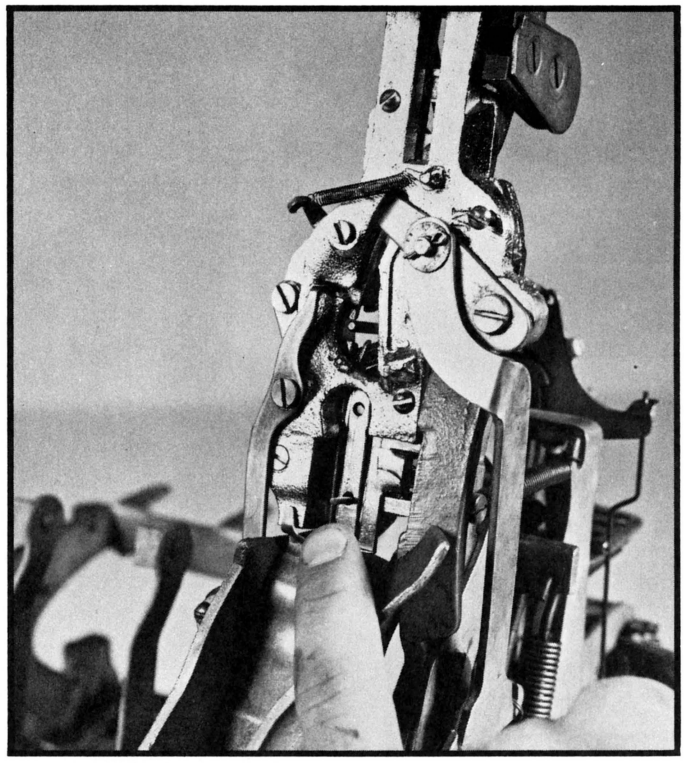


Figure C.28

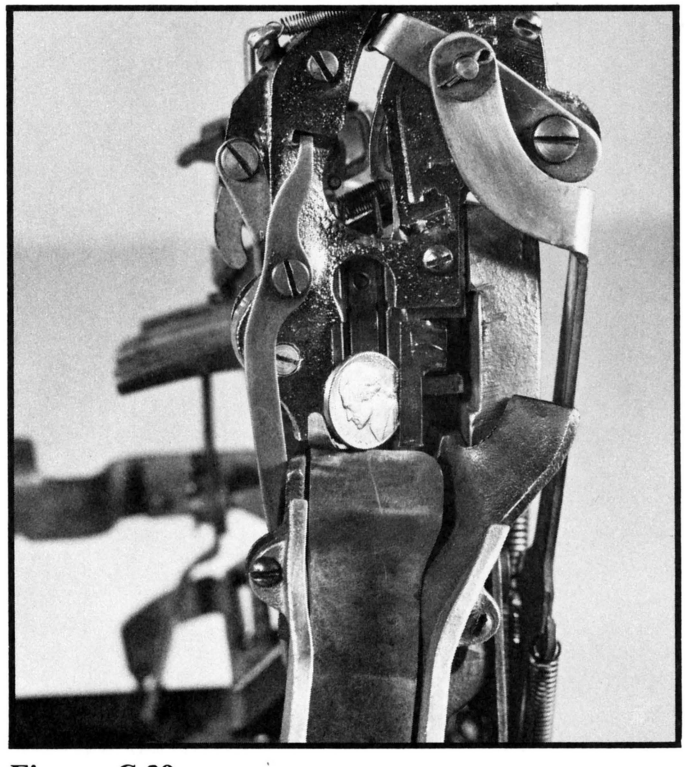


Figure C.29

check forward. If a check is present, the pin will simply pass through it and the check will proceed to fall into the coin tube (or into the jackpot if the coin tube is full). If there is a coin present, it will be swiveled, as shown in Figure C.29 and re-routed to the cashbox chute, bypassing the coin tube and the jackpot.

By using the separation device, the machine can be made to operate on either coins or checks simultaneously, but only checks are dispensed or displayed in the jackpot window—a dodge for concealing the gambling nature of the machine.

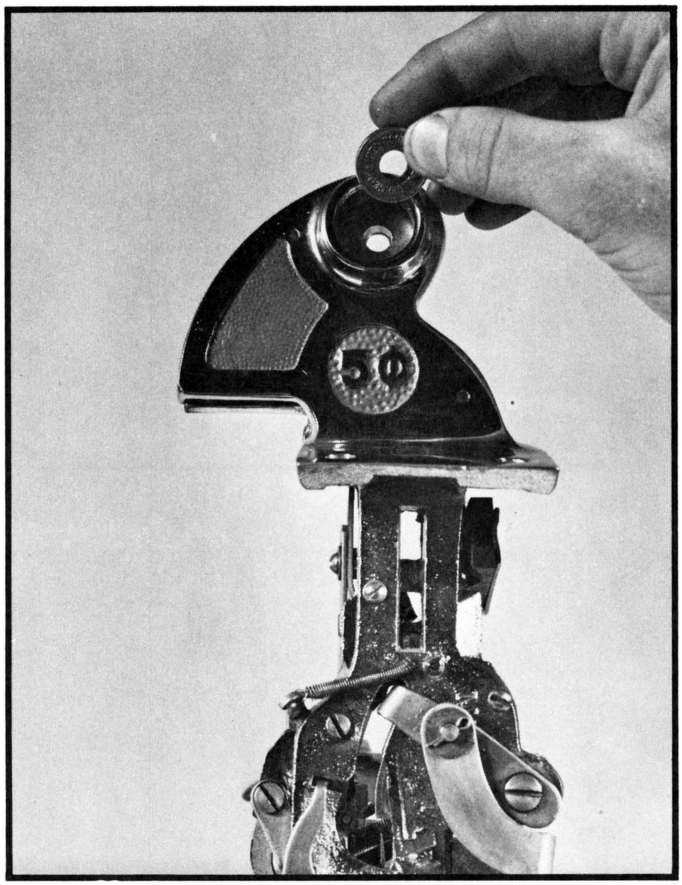


Figure C.30

Token Operation

Figures C.30, C.31 and C.32 show the operation of the gooseneck using checks rather than coins. Figure C.33 shows the check sensing pin and lever as they are found on the machine. If a coin is played immediately after a check, the gooseneck chute will appear as shown in Figure C.34.

Slug Rejection

Figure C.35 shows a metal washer being used in an attempt to cycle the machine. As can be seen in Figure C.36, the magnet has diverted the route of the ferrous washer out of the coin chute and to the right. The magnet has no effect on coins and checks because the coins are made of non-ferrous materials such as copper, silver and nickel, while the checks are usually

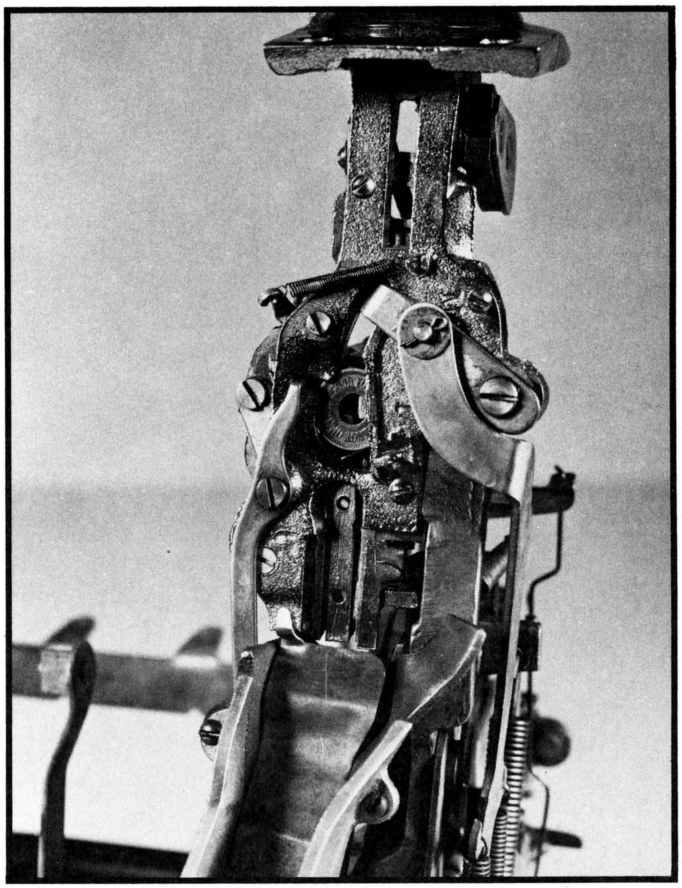


Figure C.31

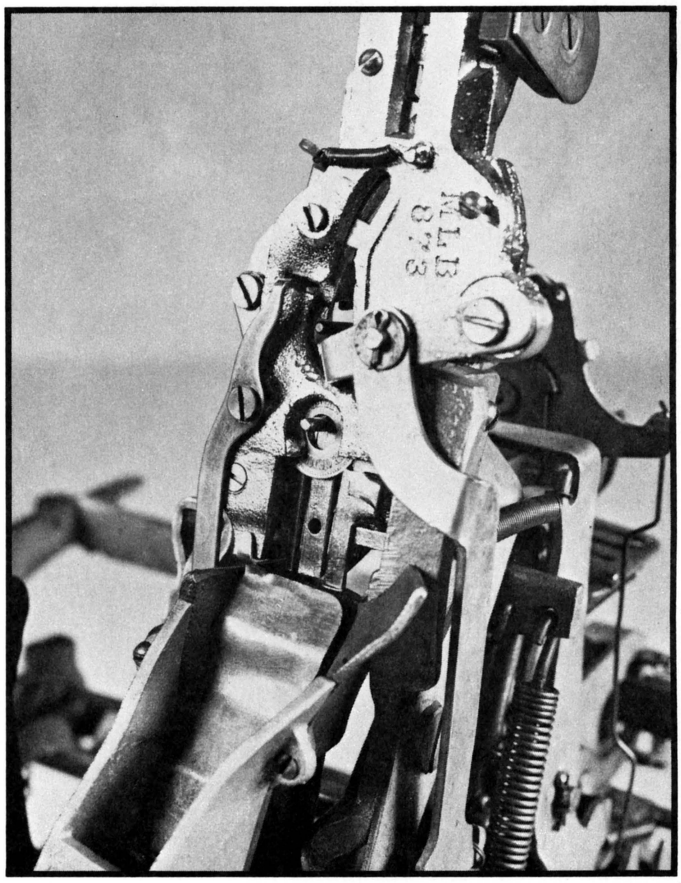


Figure C.32

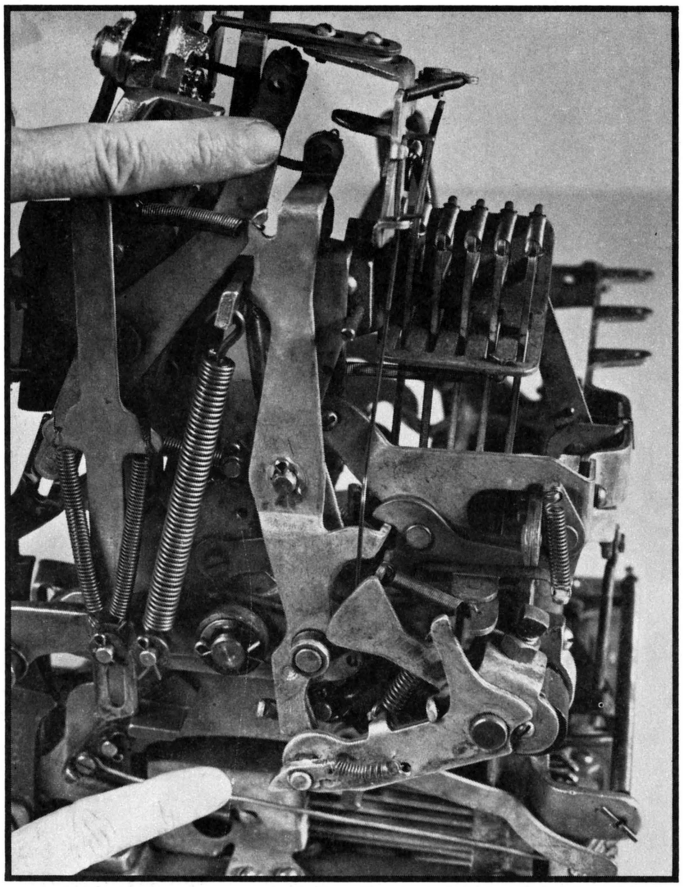


Figure C.33

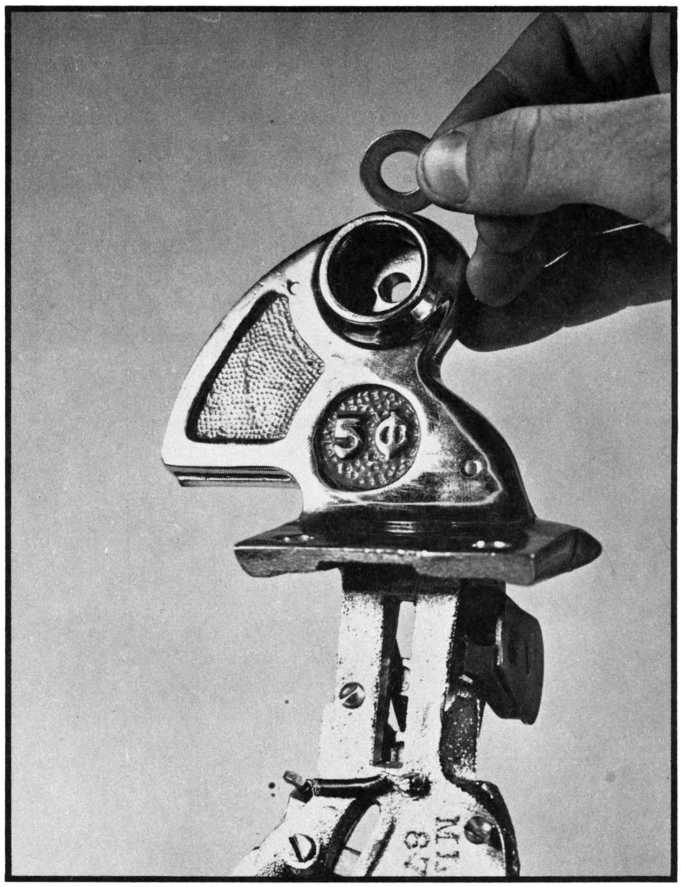


Figure C.35

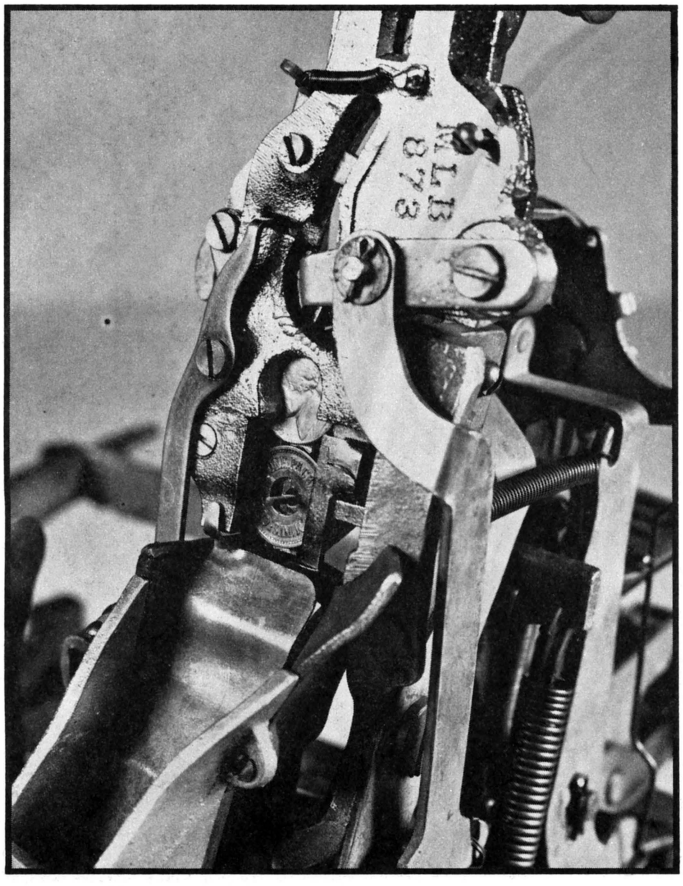


Figure C.34

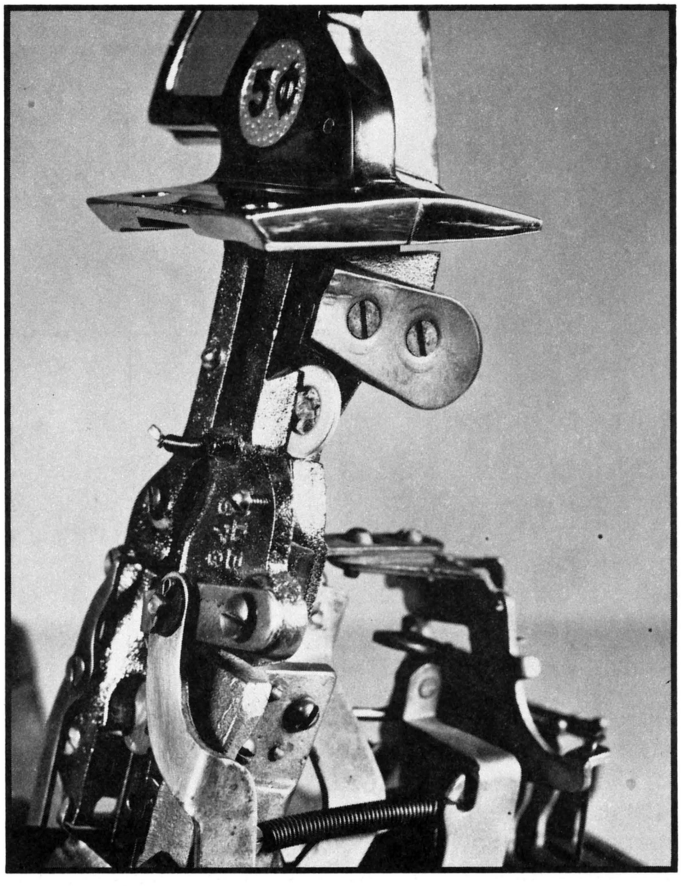


Figure C.36

made of brass or nickel.

Removal of the Gooseneck From the Mechanism

The gooseneck is removed from the mechanism by first disconnecting the coin advance bar from the advance lever as shown in Figures C.37 and C.38, and

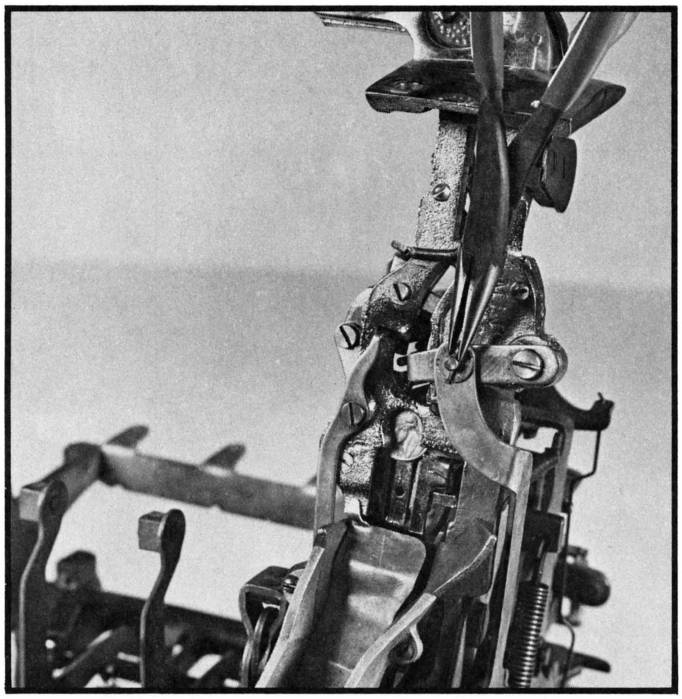


Figure C.37

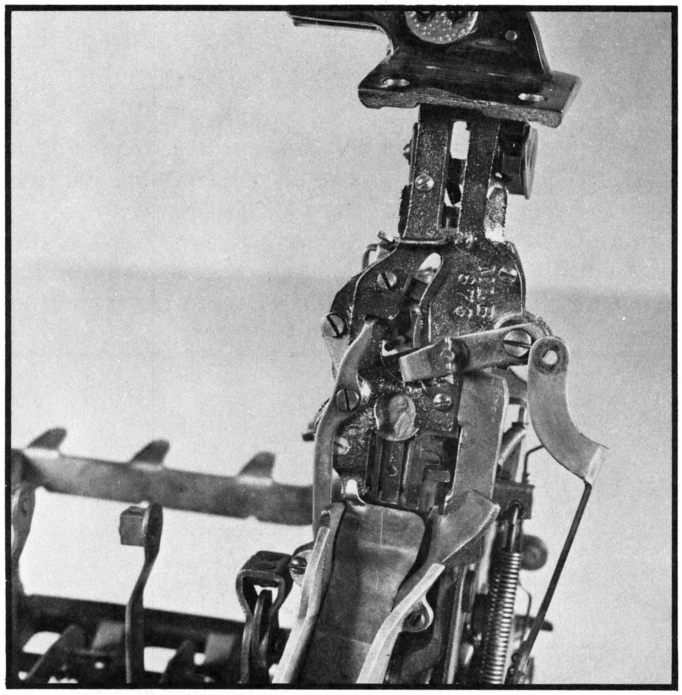


Figure C.38

then disconnecting the coin return bar, if it is present, as shown in Figure C.39. Swing these bars free from the gooseneck. Next, the two screws holding the gooseneck to the frame are removed as shown in Figure C.40, and the gooseneck is pried away from the frame over its guide pins as shown in Figure C.41. This allows it to be removed as shown in Figure C.42.

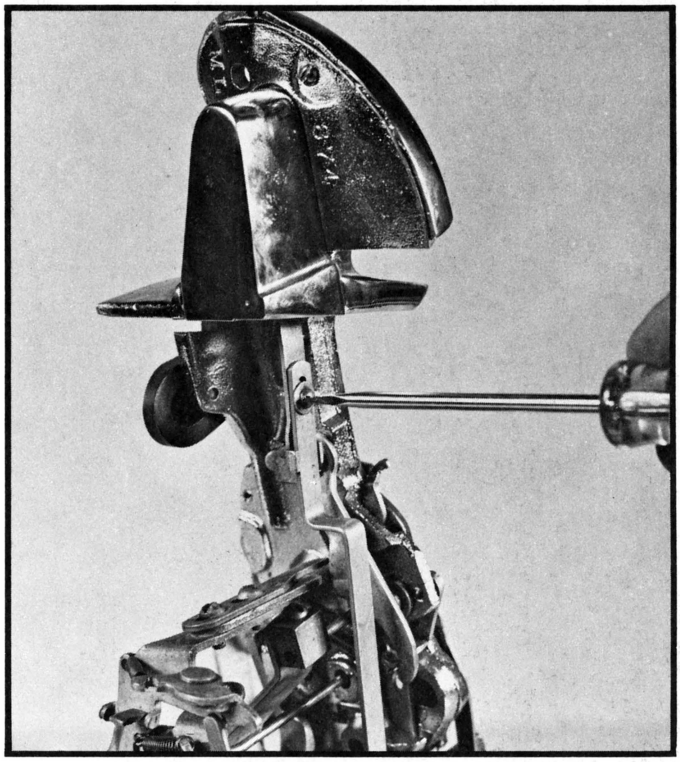


Figure C.39

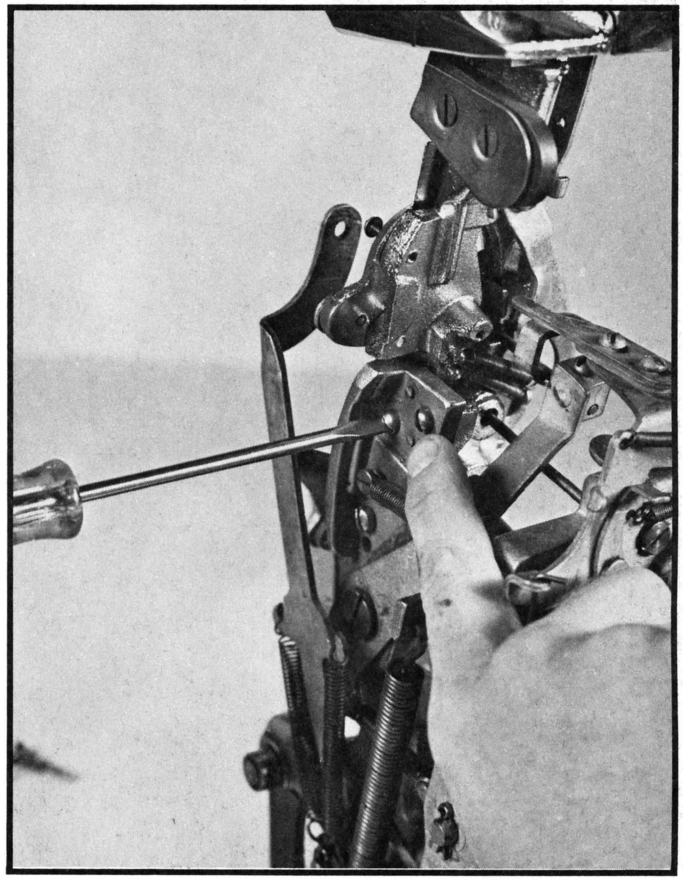


Figure C.40

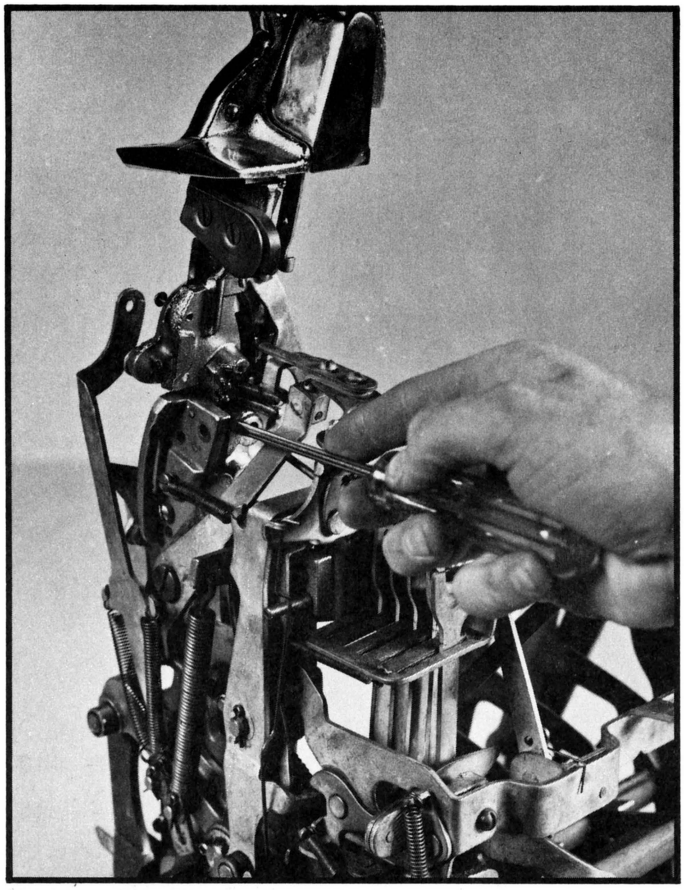


Figure C.41

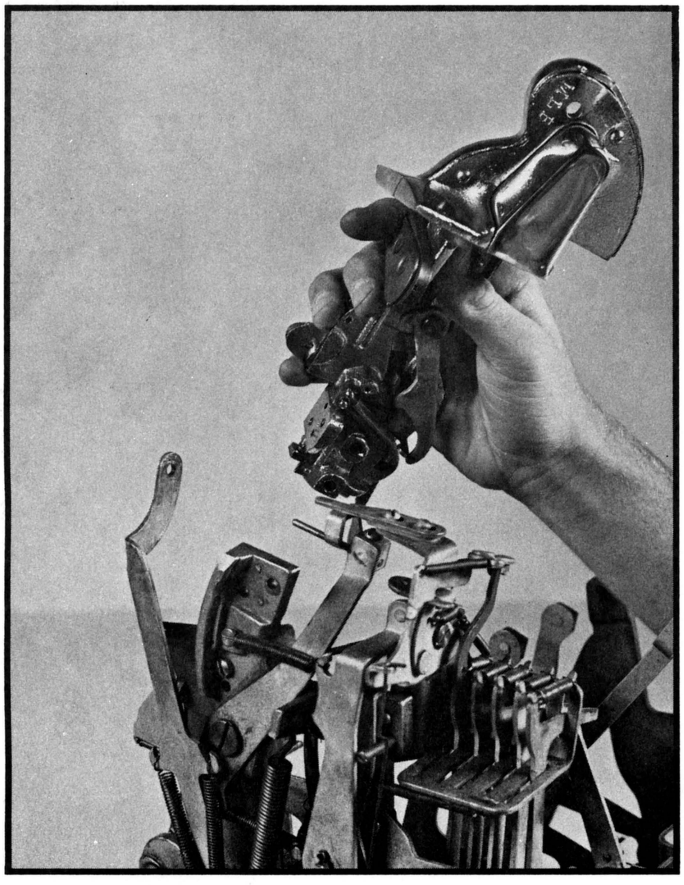


Figure C.42

Location of the Three Sensing Pins

Figure C.43 is a useful side view showing the relative placement and connections of the three sensing pins. Viewed from top to bottom they are the coin sensing pin, the check sensing pin and the coin/check separator pin. When coin separation is not desired, the pin is simply removed from the operating mechanism (this has frequently been done over the years and is the reason why the pin is usually not found with most machines).

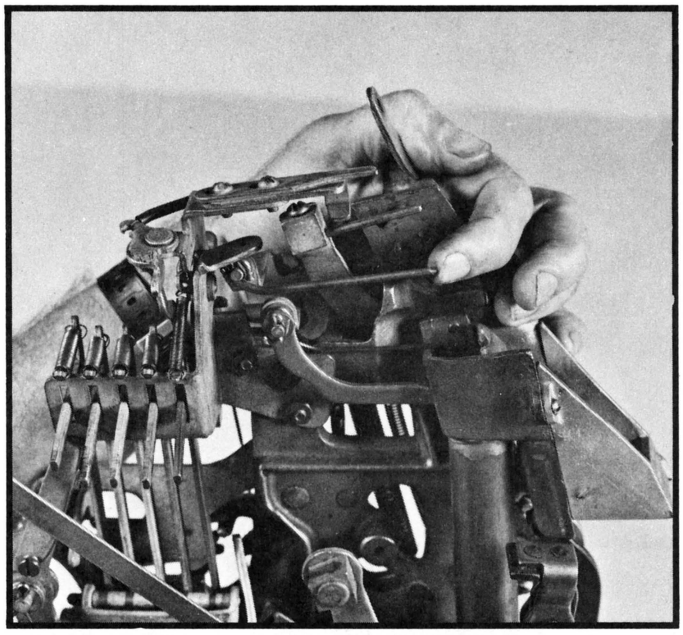


Figure C.43

Gooseneck Disassembly

The gooseneck assembly consists of a front and a back which are easily separated by removing the two screws from the back of the mechanism, as shown in Figure C.44, and the five screws from the front of the mechanism, including the coin advance lever shoulder screw as shown in Figure C.45. After the front and the

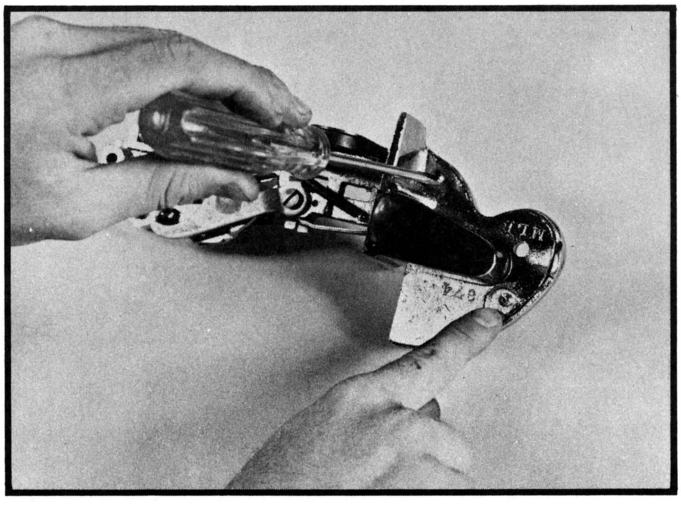


Figure C.44

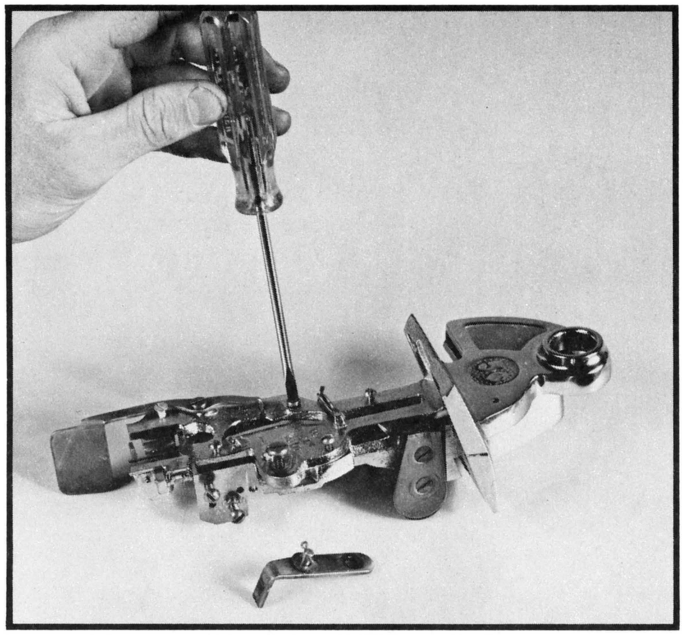


Figure C.45

back of the gooseneck have been separated, they will appear as shown in Figures C.46, C.47 and C.48. Further disassembly can proceed if required, but this level (except for replating) is usually sufficient for cleaning purposes and repair.

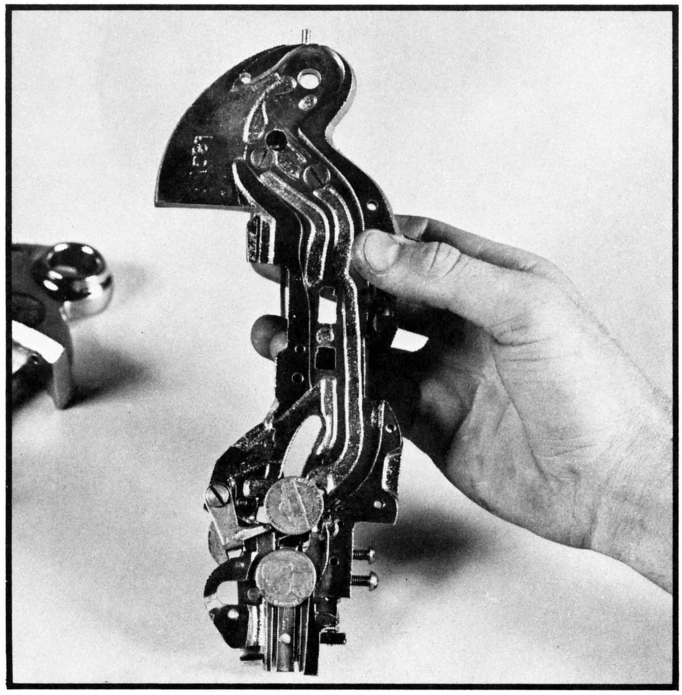


Figure C.46

Anti-Cheat Features

Several anti-cheat features have been built into the gooseneck. The coin advance lever prevents yo-yoing the coin (putting a string on the coin and using it more than once), since it forces the coin into the gooseneck. Moreover, the sensor lever, illustrated in

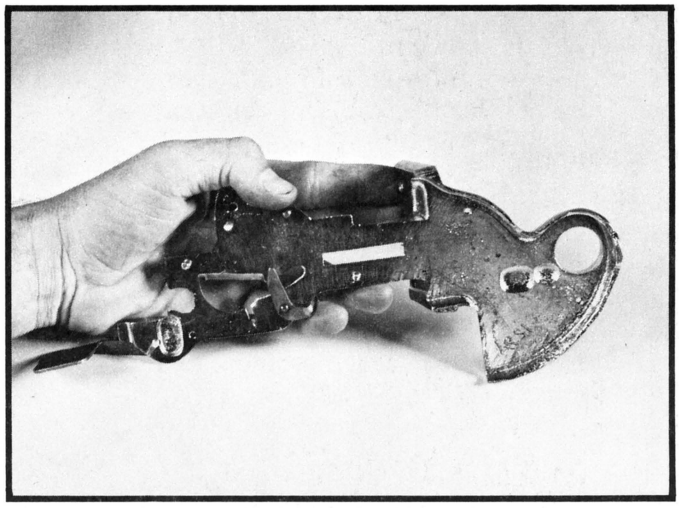


Figure C.47

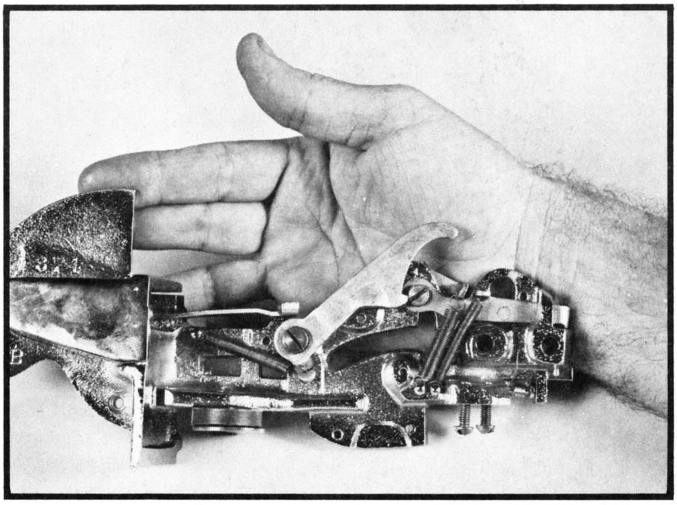


Figure C.48

Figure C.49, will lock up the machine, preventing operation, if an attempt is made to cycle it without a coin present. This is accomplished in the same manner as the operating lever stop assembly explained in Chapter 7, Figures 7.15 through 7.19.

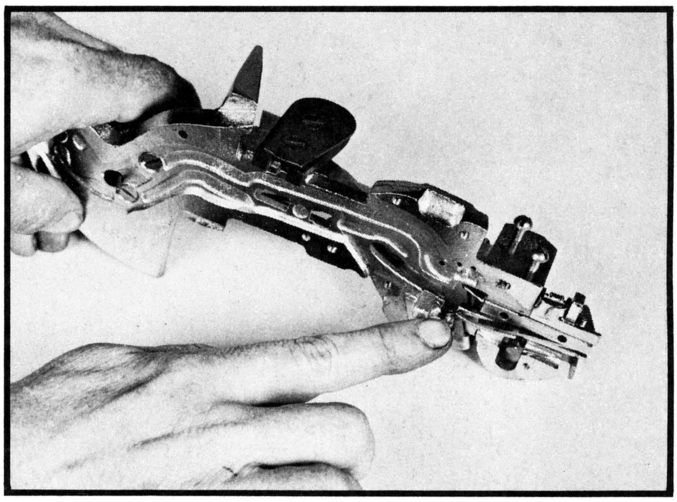


Figure C.49

Tilting or jarring the machine sharply will inhibit coin travel as shown in Figure C.50. Notice that the tilt lever swings into the coin path and prevents the coin from entering the cradle for detection.

Reassembly

The gooseneck can be reassembled and placed back onto the machine by reversing the procedures and figures previously given. The gooseneck is, surprisingly enough, a relatively complicated device which seems to have been over-looked and taken for granted. As can be seen, nothing could be further from the truth.

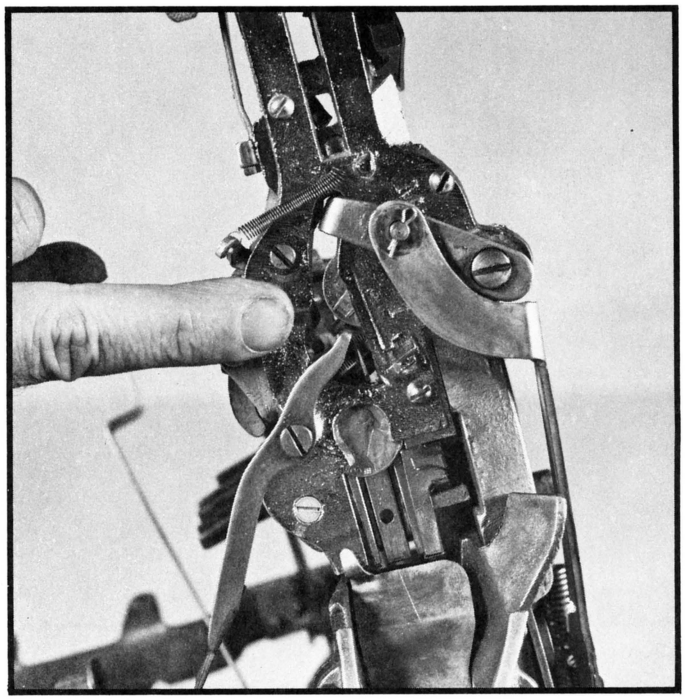


Figure C.50

D

Later-Style Jackpot Assembly

Introduction

The jackpot assembly described in this section was the most modern jackpot to accompany any of the Mills gooseneck machines. This particular jackpot was selected not only for its relative sophistication, but also because it is easily removed from any vendor-front case and therefore convenient to photograph.

Figure D.1 shows the jackpot assembly installed in

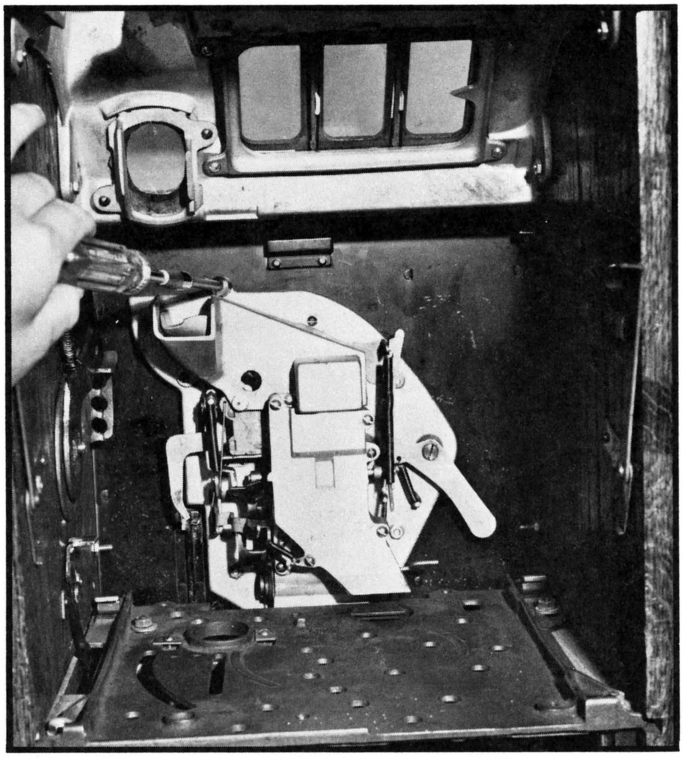


Figure D.1

the case as viewed from the rear. By removing the four nuts with a socket driver, the entire jackpot assembly can be removed. It is shown in Figures D.2 and D.3.

Jackpot Coin Flow and Management

Coins enter the jackpot assembly from the gooseneck through one of the jackpot's two chutes. Figure D.4 illustrates coins entering into the inner chute of

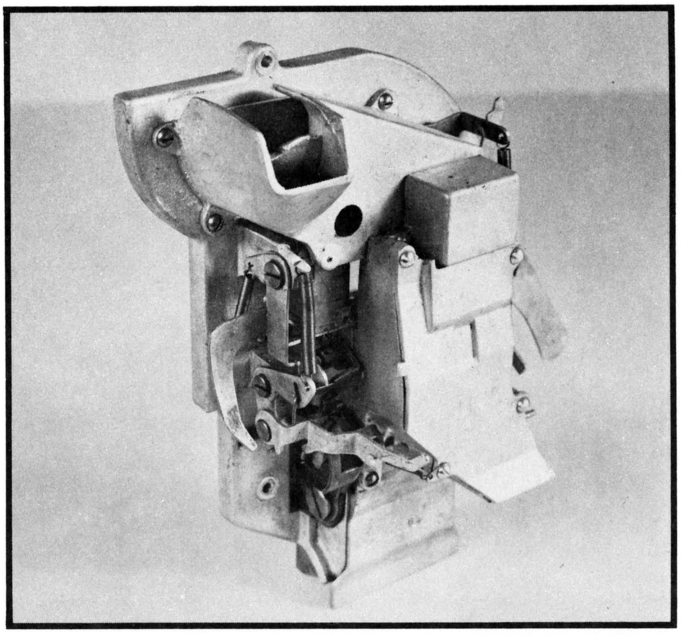


Figure D.2

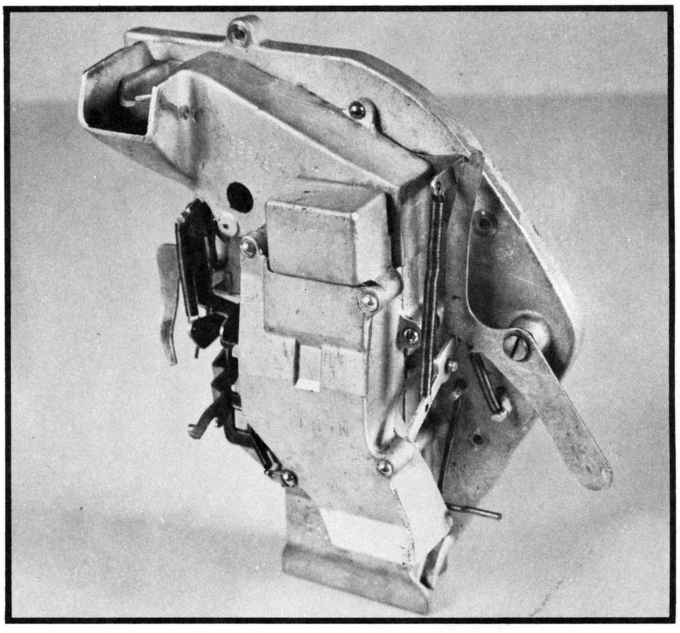


Figure D.3

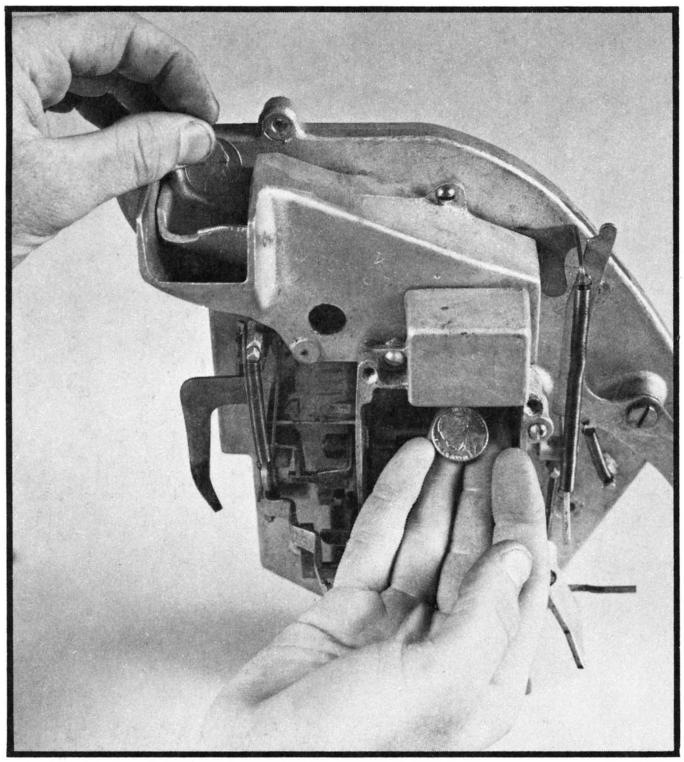


Figure D.4

the jackpot in the separation mode. From here the coins proceed to the cashbox compartment by exiting the jackpot assembly as indicated by the right hand in Figure D.4.

Normally, when separation is not being used, the coins enter the jackpot as shown in Figure D.5. After entering, the coins attempt to fill the reserve jackpot

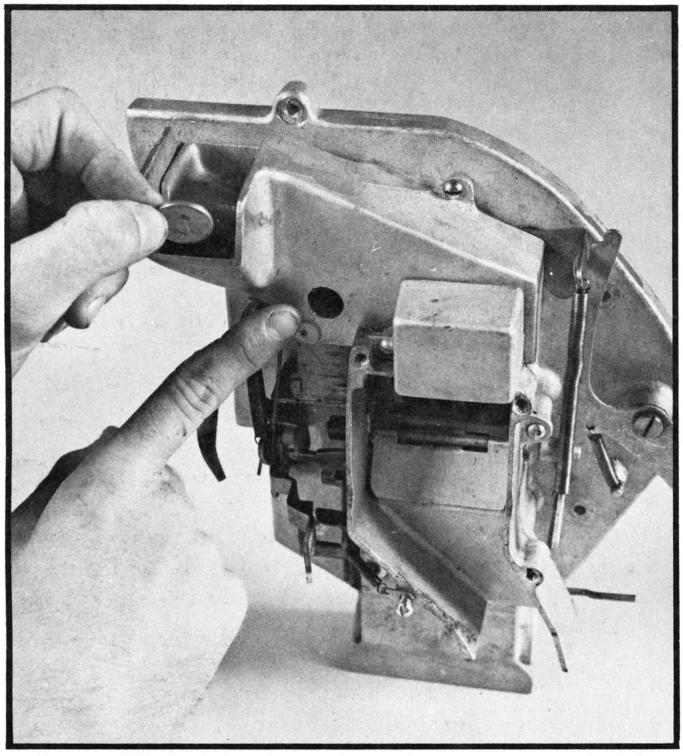


Figure D.5

located behind the forefinger in Figure D.5. After the reserve jackpot has been filled, the coins proceed to the main jackpot indicated by the forefinger in Figure D.6. After the jackpot has been filled, the coins will

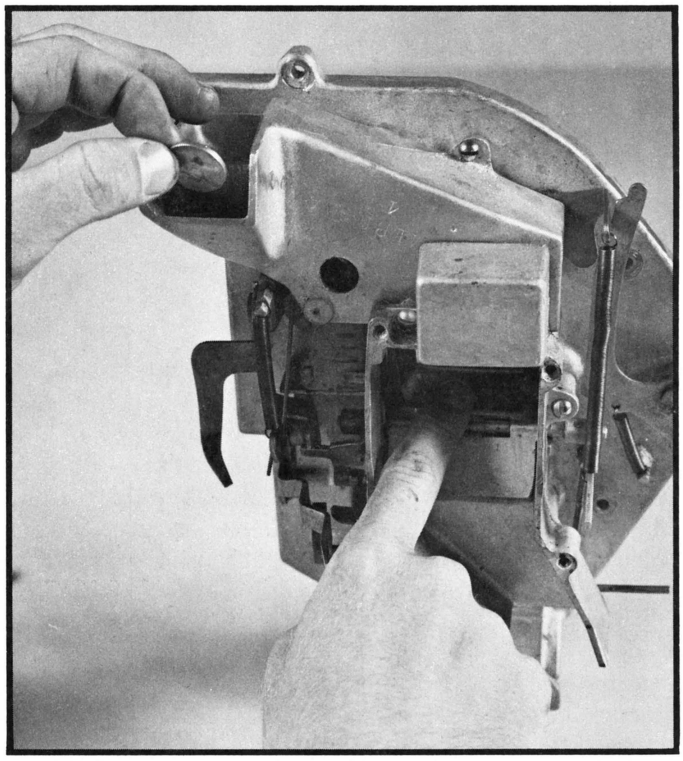


Figure D.6

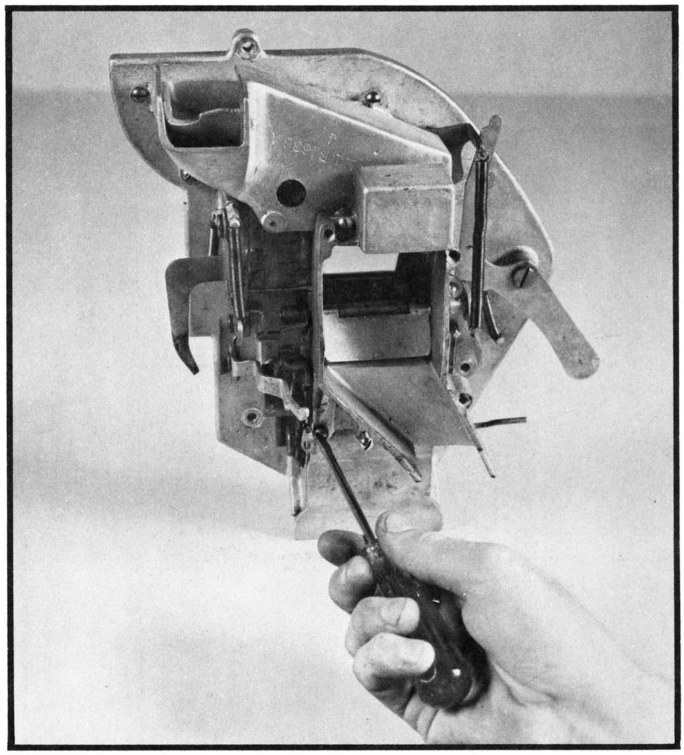


Figure D.7

naturally spill over and enter the main chute which leads to the cashbox compartment.

It should be noted that in the proceeding three fig-

ures, the back plate of the coin box chute has been removed for purposes of explanation. Additionally, as the description of the operation of the jackpot proceeds, more and more parts will be removed, thus providing a disassembly technique simultaneously.

Jackpot Door Operation

Access to the main jackpot door is achieved by removing the side casting of the coin chute as shown in Figures D.7 and D.8, thus permitting the removal of the jackpot door as seen in Figure D.9. The operation of the jackpot door is illustrated in Figures D.10 (door closed) and D.11 (door open).

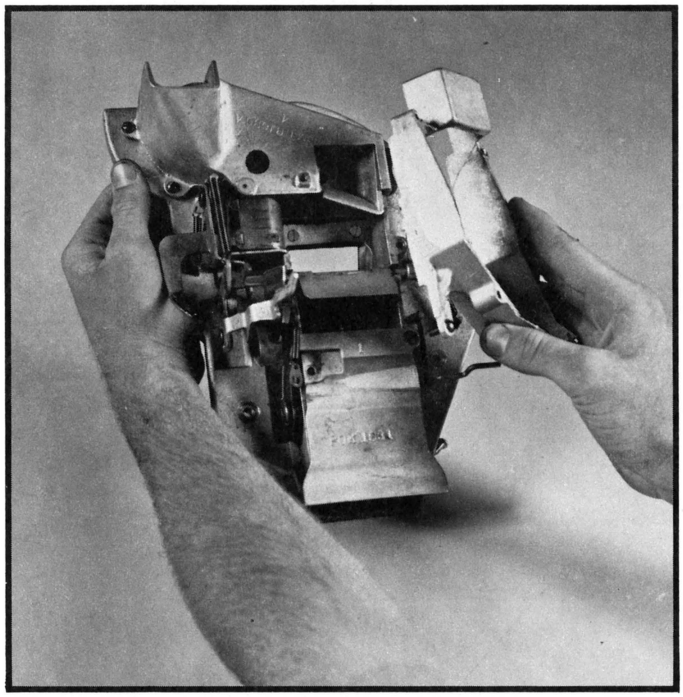


Figure D.8

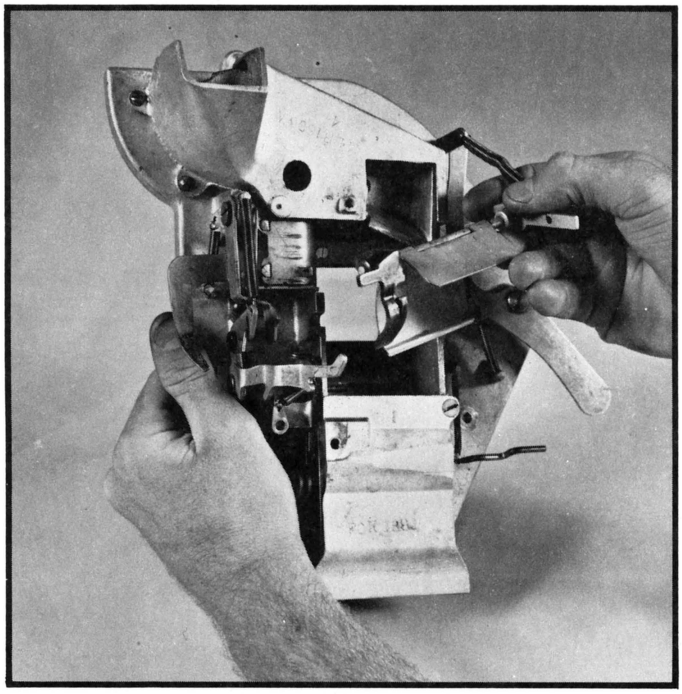


Figure D.9

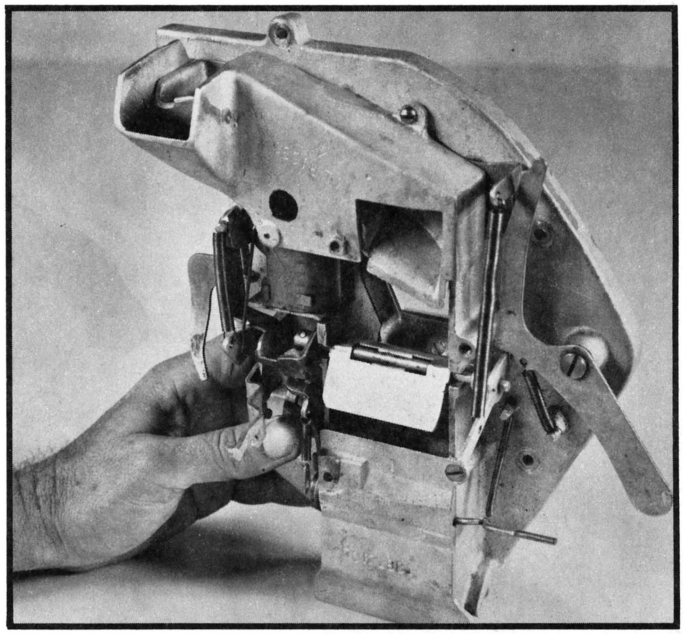


Figure D.10

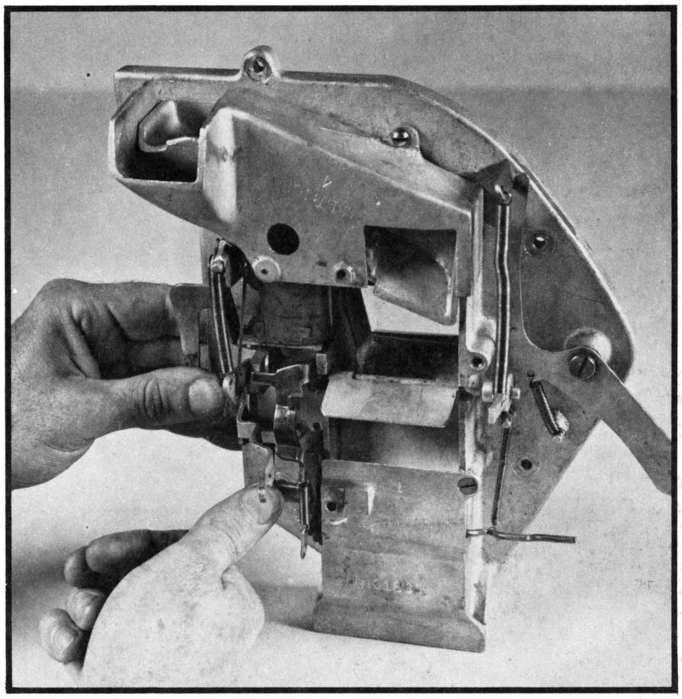


Figure D.11

In order for the jackpot door to be operable (armed) it is neccessary for the arming lever to be pressed forward as shown by the thumb in Figure D.11. In actual machine operation this is accomplished by the physical insertion of the mechanism into the cabinet. This arming feature is necessary because the jackpot is triggered by the twenty-pay slide when it retreats into the mechanism; this is the identical motion which occurs when the mechanism is removed from the case. The arming lever is used to lock up the jackpot thus preventing it from triggering when the

mechanism is removed from the case.

Reserve Jackpot Operation

Figure D.12 shows the forefinger pointing at the reserve jackpot in a partially open position. The reserve jackpot normally stays in the position shown in Figure D.13. It is activated by the indicated linkage upon the resetting of the main jackpot door to the position shown in Figure D.14. On the next cycle of the machine, the jackpot pushbar resets the reserve jackpot to its initial position as previously shown in Figure D.13.

When the main jackpot door is open, the reserve

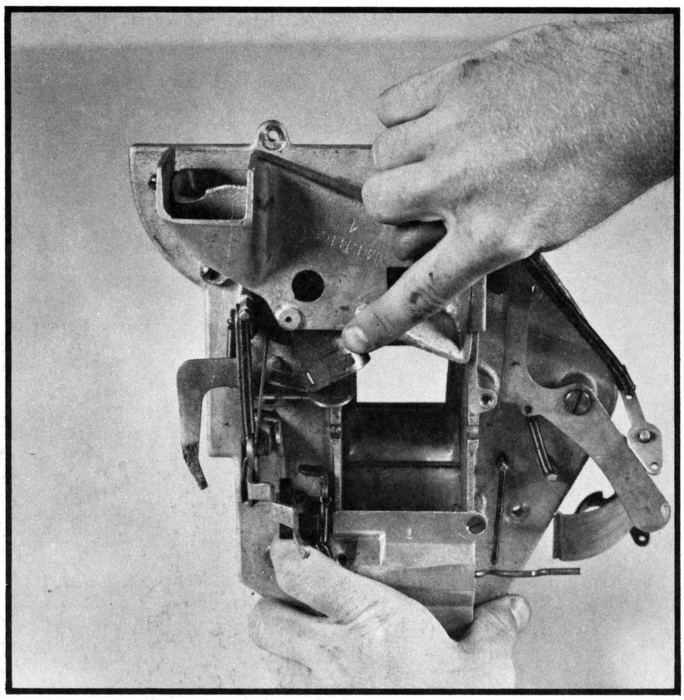


Figure D.12

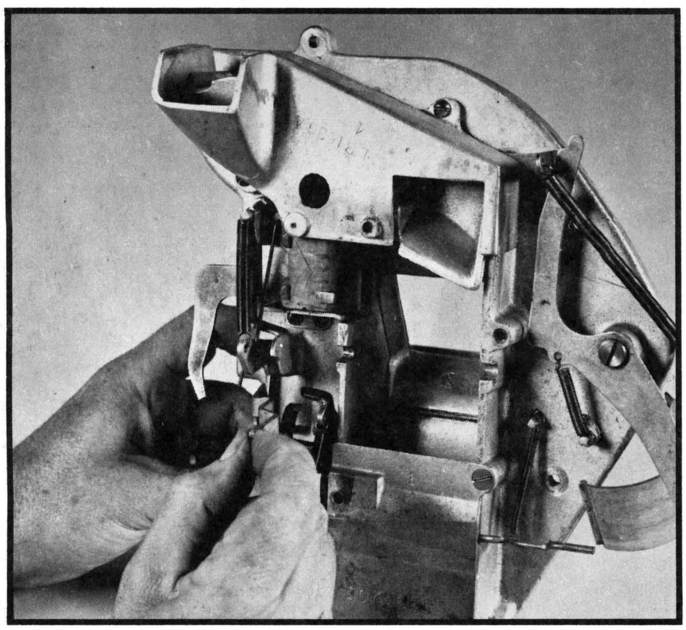


Figure D.13

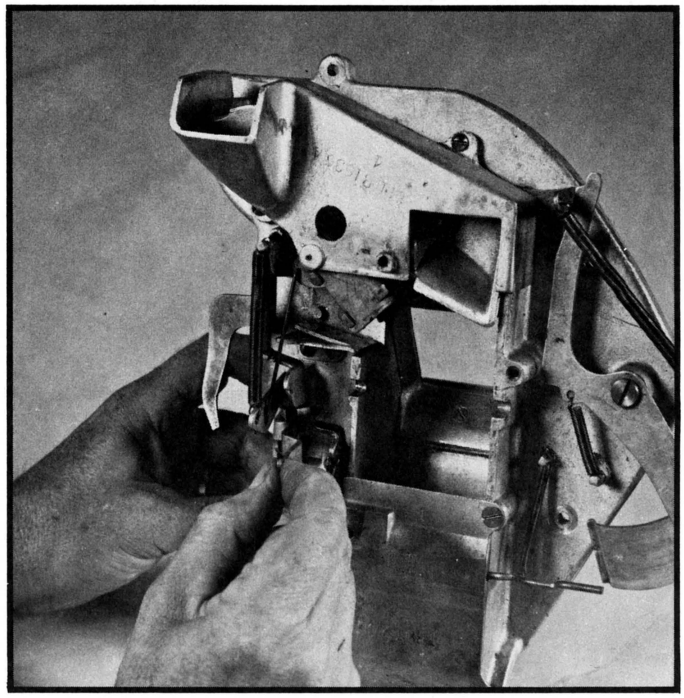


Figure D.14

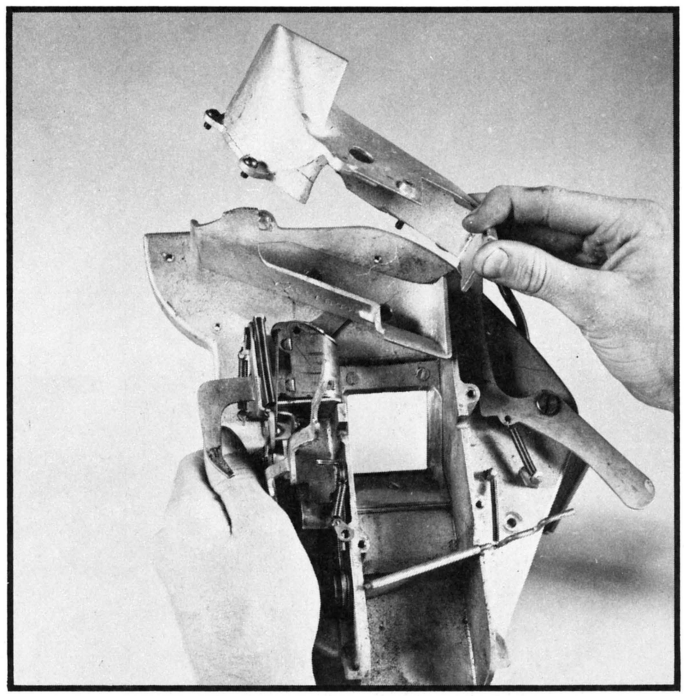


Figure D.15

jackpot becomes vulnerable to tampering via a wire being forced up the jackpot chute. In order to prevent tampering with the reserve jackpot, the top of the reserve jackpot is covered with a flat lever. Figure D.15 shows the chute leading to the cashbox being removed to provide better visibility of the reserve jackpot lid as indicated by the forefinger in Figure D.16. After the main jackpot door has been closed, the lid is lifted as shown in Figure D.17 and will once again permit rotation of the reserve jackpot (better shown in Figure D.18).

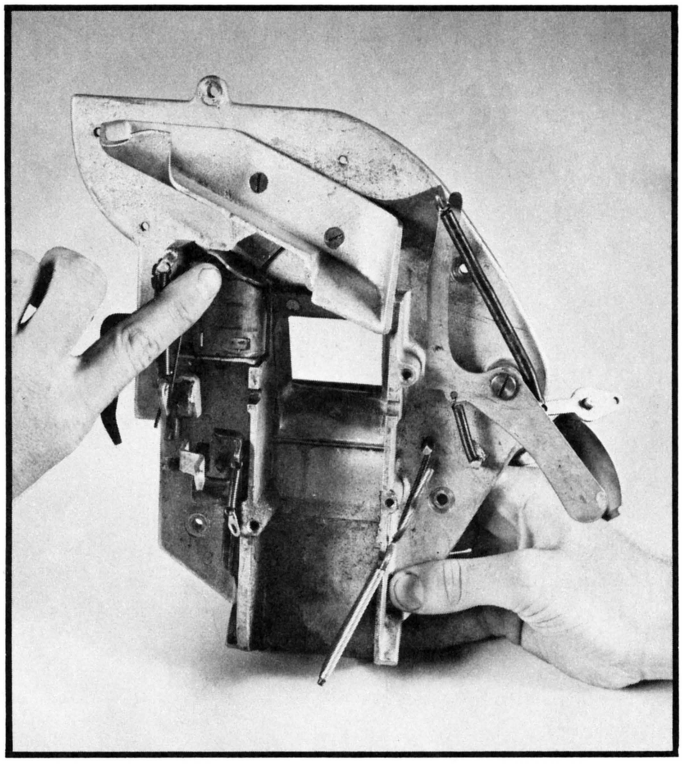


Figure D.16

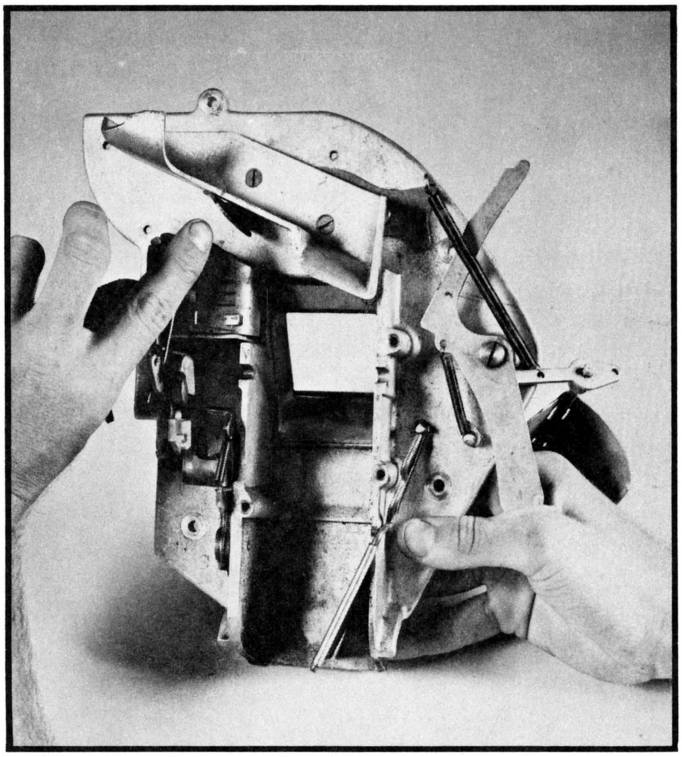


Figure D.17

Anti-Spooning Mechanism for Main Jackpot

In order to insure that a spooning attempt cannot be made after the release of the main jackpot, a second swivel door was installed below the main jackpot door to insure that there is no foreign object in the chute. This anti-spoon door is shown in Figure D.19

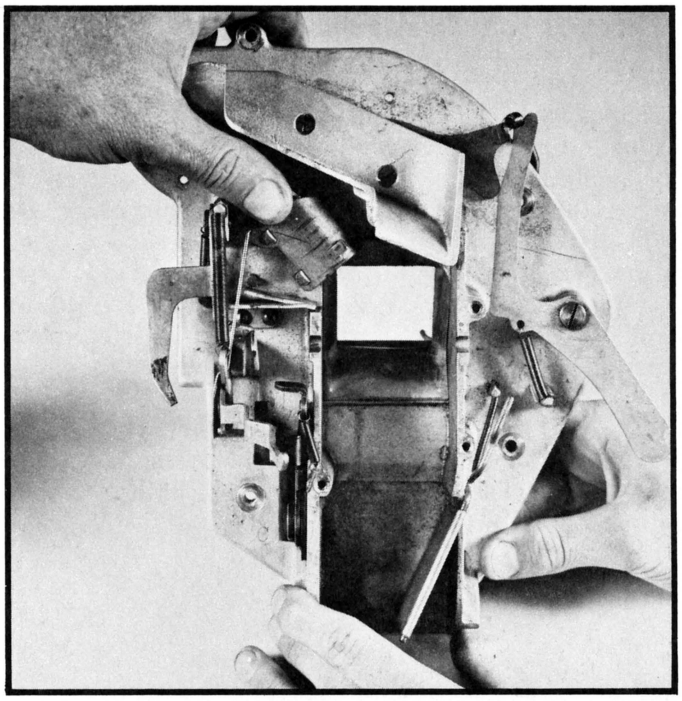


Figure D.18

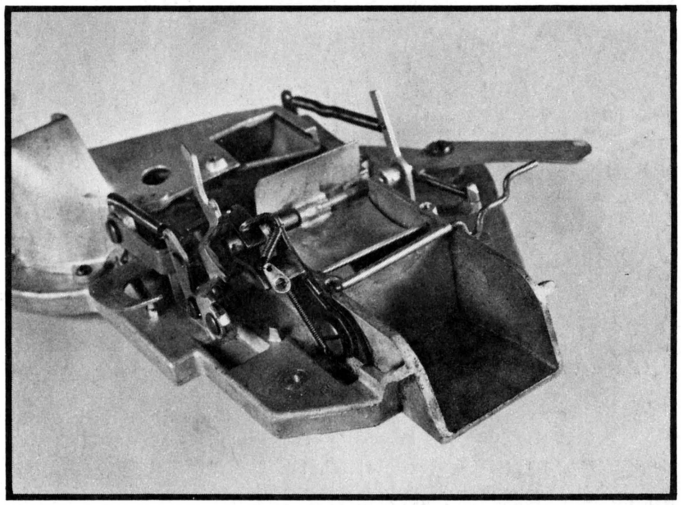


Figure D.19

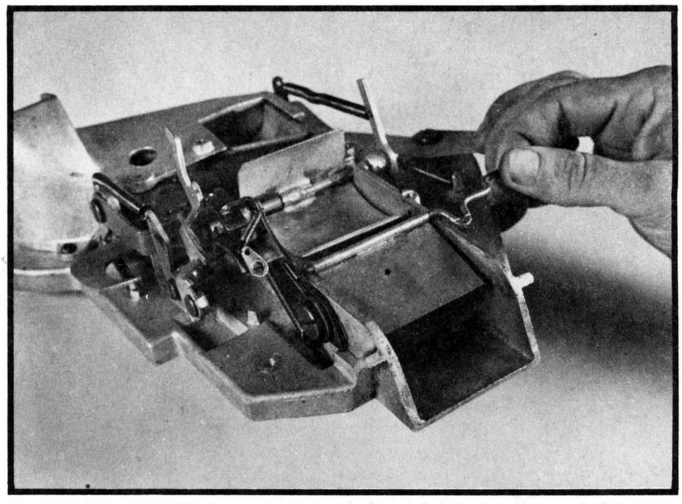


Figure D.20

in the closed position and in Figure D.20 in the open position. It should be noted that this door is lightly spring loaded and opens upon pressure of the coins released from the jackpot. While the anti-spoon door is open, the rod extending from it is rotated in such a manner as to interface with the clock fan stop lever. When the door is closed as shown in Figure D.21, the clock fan is free to operate. When the anti-spoon door is open, it forces the fan stop lever into the clock fan as shown in Figure D.22, thereby preventing future cycling of the machine and preventing possible tampering of the jackpot door.

Disassembly of the Jackpot Assembly

Remove the four nuts with a socket driver, as shown in Figure D.1, to remove the jackpot assembly

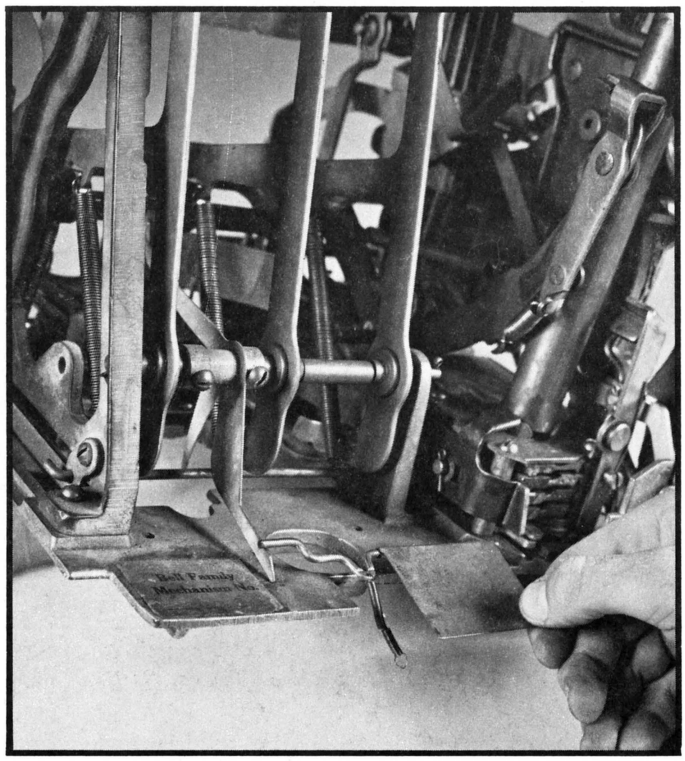


Figure D.21

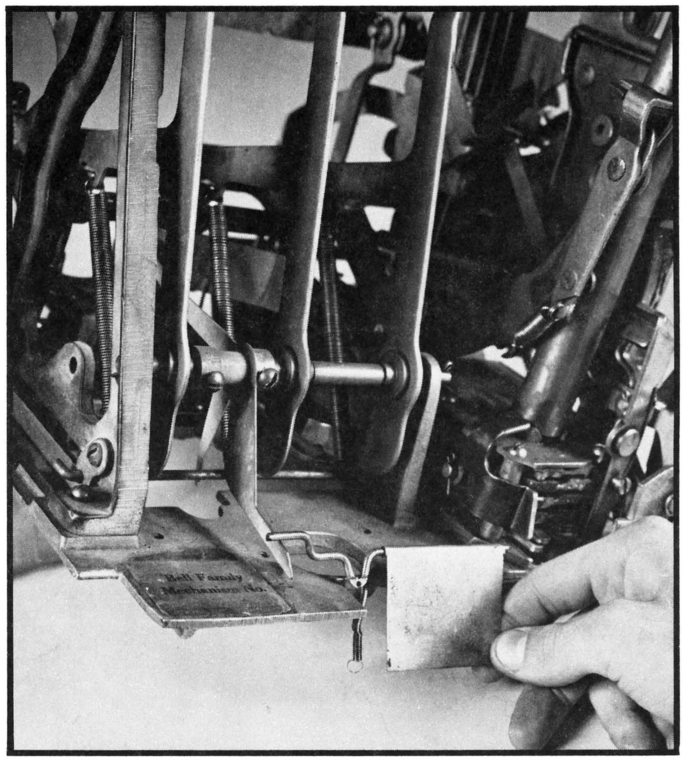


Figure D.22

from the case. To gain access to the main jackpot door, remove the side casting of the coin chute as shown in Figues D.7 and D.8. The jackpot door itself can now be lifted out as shown in Figure D.9. The chute leading to the cashbox can now be removed as shown in Figure D.15.

At this stage, most of the parts are easily accessible for cleaning, and reassembly is accomplished by reversing the above procedures. Care should be taken in adjusting the anti-spooning rod's interface with the mechanism as well as the arming lever and slide interface with the jackpot release levers. These adjustments can easily be observed by removing the upper half of the front of the case, and the adjustments can be made while the mechanism is in the case.

E Skill Stop Levers

Introduction

Figure E.1 shows a typical machine which employs skill stops. The three buttons located on top of the machine may be pushed anytime after the reels are spinning to cause the particular reel to stop prematurely, thereby imparting "skill" to the play of the machine.

Figure E.1

Figure E.2 shows the skill stop mechanism removed from the case. It is the paddle-like levers on top of the reels which cause the premature stopping of the reels, when they are depressed by the skill buttons on top of the case. This interface action between the case and the mechanism is illustrated in Figure E.3 where the forefinger simulates the pressing of a skill stop button on the case.

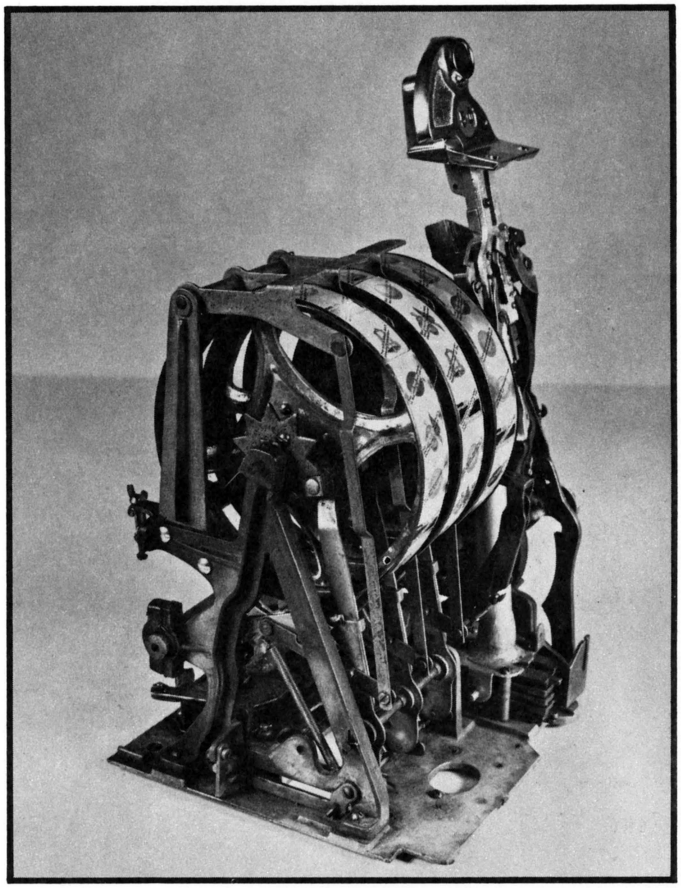


Figure E.2

Skill Stop Lever Operation

Figures E.4 and E.5 show the operation of the skill stop action during the unwind cycle of the machine; the clock is being stalled by the pair of pliers shown. The forefinger in Figure E.5 shows how the linkage connects the upper portion of the mechanism to the reel stop lever allowing it to be released.

Figure E.6 shows the machine during the wind-up cycle and as the reel stop lever is being reset (indicated by the forefinger). If there is an attempt to press the skill stops during the wind-up cycle, as simulated in

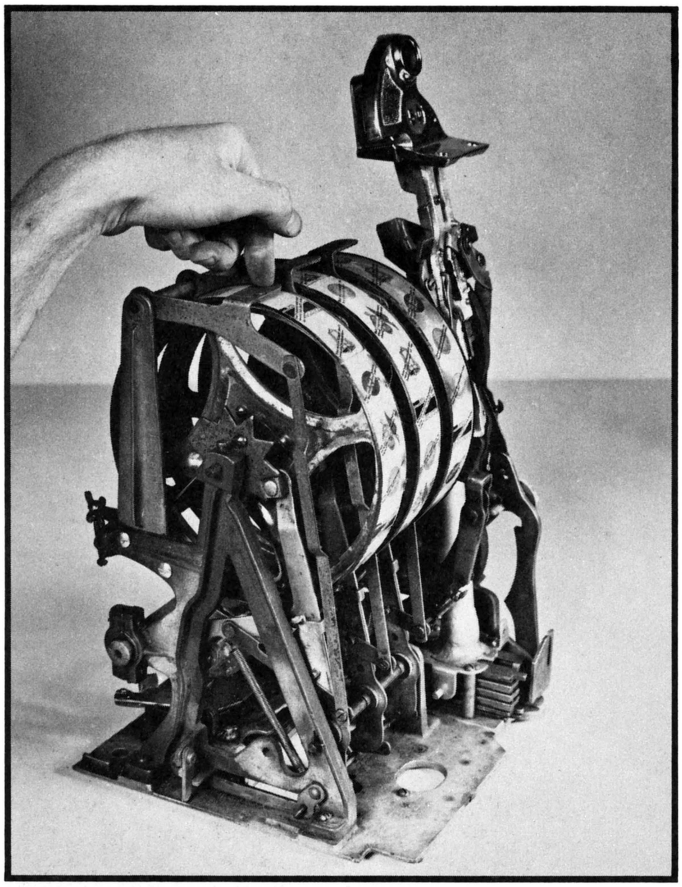


Figure E.3

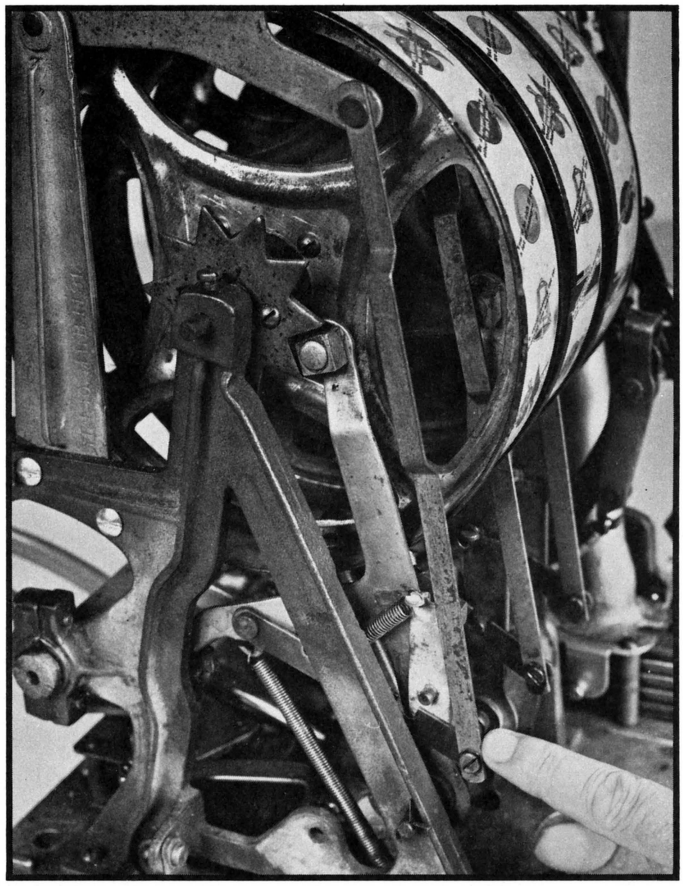


Figure E.5

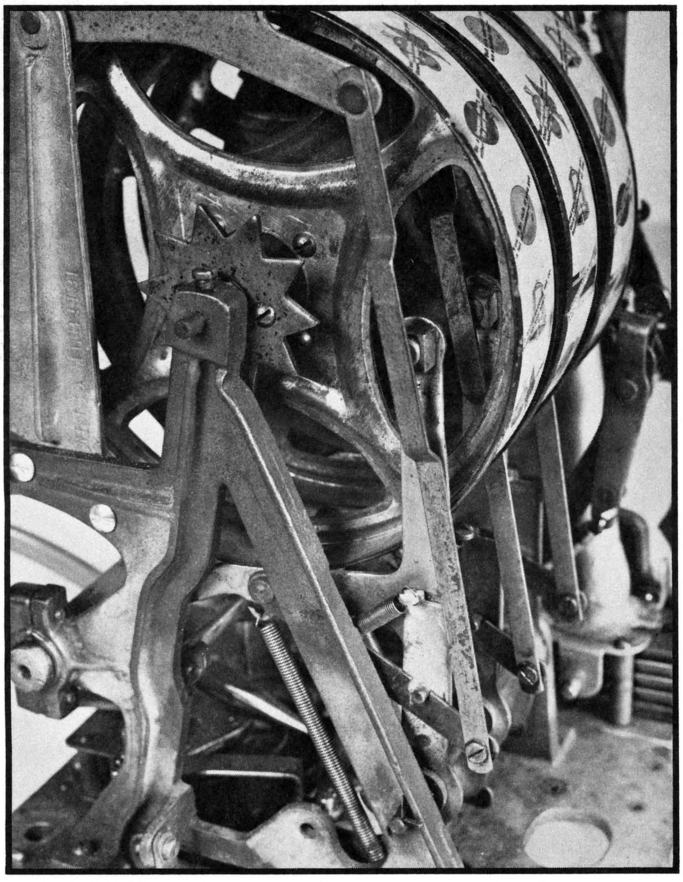


Figure E.4

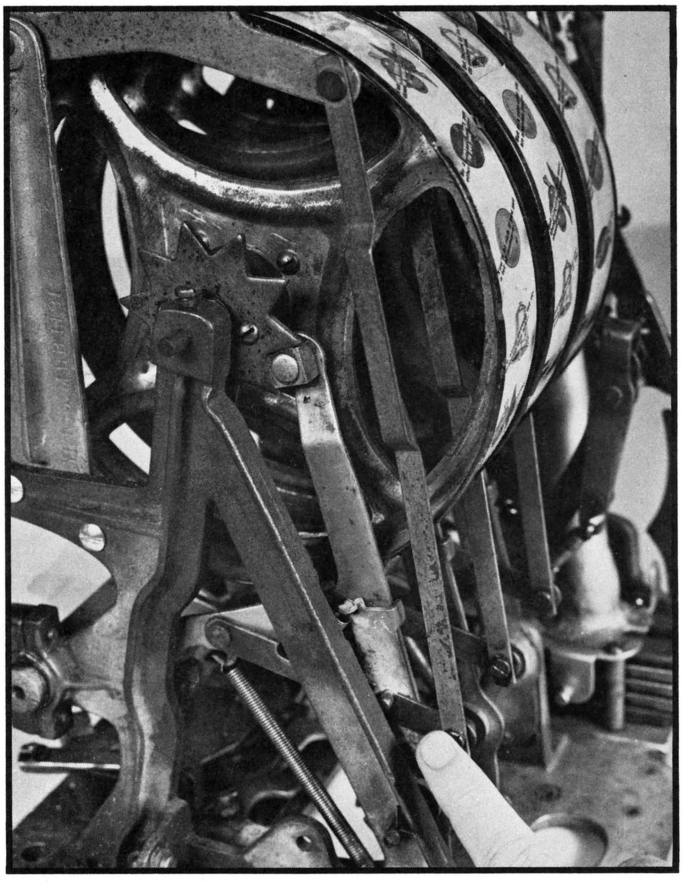


Figure E.6

Figure E.7, the main operating fork will prevent the action of the reel stop lever until the fork has been released, as shown in Figure E.8.

When the machine is placed into its wind-up cycle, the operating fork resets the skill-stop reel assembly as shown in Figure E.9 and keeps it reset until the machine enters its unwind cycle.

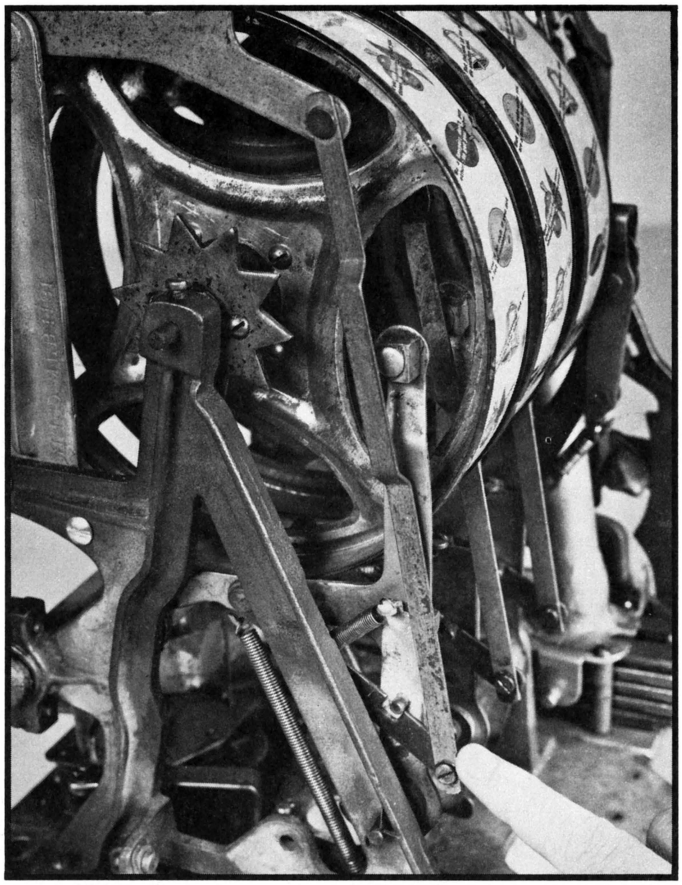


Figure E.7

Figure E.8

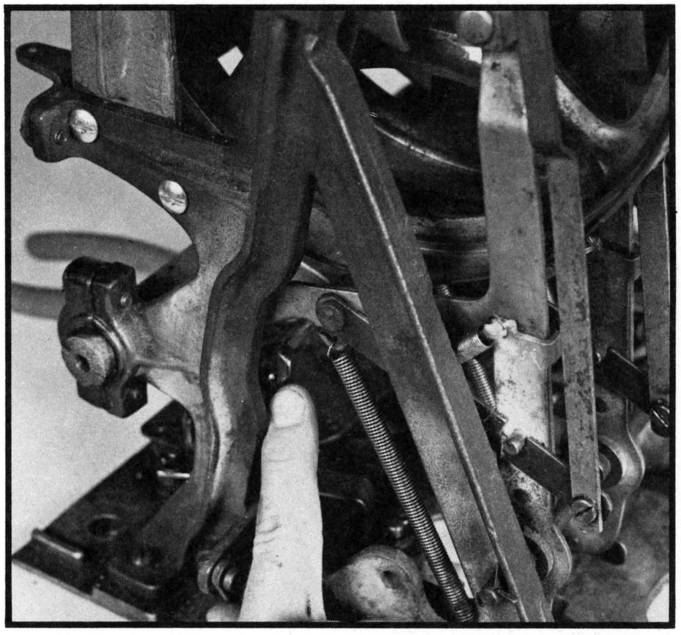


Figure E.9

F The FUTURITY Bell

Introduction

In 1936 the Mills Novelty Company introduced a new slot machine which sounded too good to be true—it guaranteed a winner. It was called the FUTURITY.

Figure F.1 shows a typical Mills FUTURITY bell slot machine with a gold award feature. The basic feature of the FUTURITY was to return the player's money if the machine was played ten times without showing a winning combination.

The pointer on the dial at the top of the machine was reset to zero (0) whenever a winner was paid. Each additional play cycle of the machine without a winner indexed the pointer by one number until it reached 10, at which time the machine paid out 10 coins. The pointer was then reset to zero. This concept could be interpreted as insurance against a losing streak.

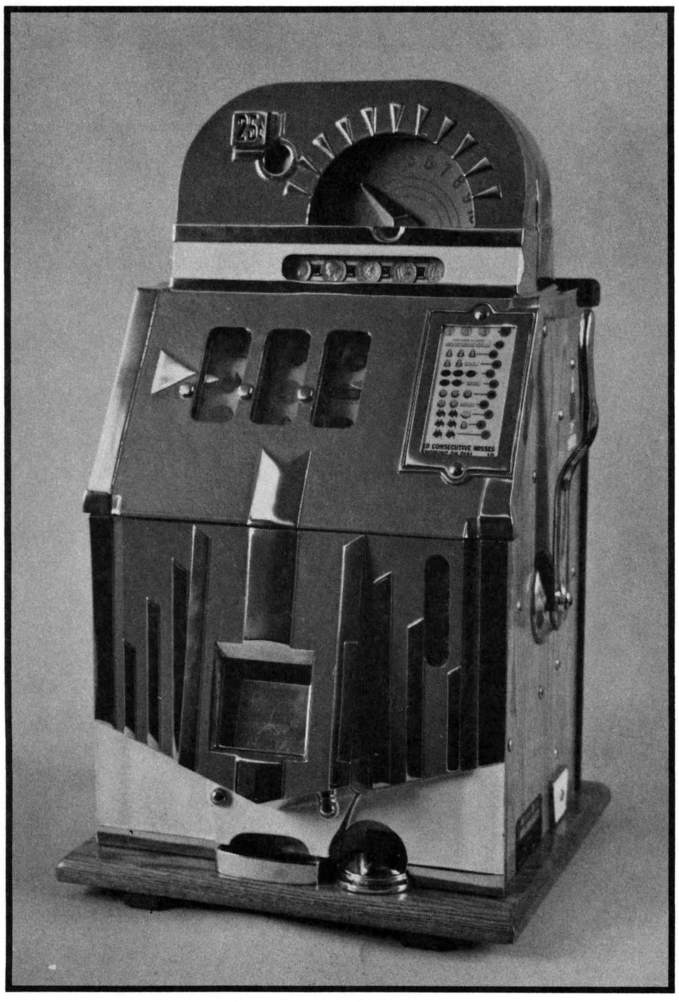


Figure F.1

The real impact that the FUTURITY concept had upon the player was to encourage continued play of the machine the closer the pointer was to 10—a lure for the player hoping for losers as the pointer approached 10! Whenever the pointer reached 9 the player had to play once again since he was assured of winning at least two coins if he won and was guaranteed 10 coins if he lost! When the pointer was at 8 the player was assured of at least breaking even, and at 7 it seemed he had a good chance of getting to 8, assuring a favorable ending of the game.

The argument on the lower end of the dial provided the player with at least his money back if the machine produced a winner within the first 2 plays plus an excellent chance for indexing the pointer to 3. Thus it was only when the FUTURITY's pointer was on the numbers 3 through 7 that the player faced the possibility of losing. Since most machines of this vintage would get a winner once out of five plays, it seemed like a good bet to play five times hoping to *not* have a winner.

The above arguments are all very sound for a "normal" slot machine. But the FUTURITY was a wolf in sheep's clothing—designed to be the ultimate mechanical cheating device. While offering an optimistic prospectus, it was the forerunner of the hostile takeover (of the players' money)!

The Basic Concept of Operation

The FUTURITY was really two slot machine mechanisms in one case. One mechanism, which we shall call *"N"* for normal, had its reels designed for a payout of two cherries or better 64% of the time. But the other mechanism, called *"C"* for cheater, had its reels designed to produce a winner only 0.26% of the time!

Table F.1 shows the expected return per coin played and the probability of getting any winner on the *N* or *C* machines.

By allowing the player to lose on machine *N* until the

MODE STATISTICS		
	MODE *N*	MODE *C*
Average Return	223%	24.00%
Probability of Win	64%	00.26%

Table F.1

pointer had passed 3 or 4 and then switching to machine *C*, the player would invariably lose during the *C*-phase, then receive his bet back plus one during the N mode. The fact that the two mechanisms are combined into one housing and automatically switched (without the player's knowledge) is the engineering marvel of the FUTURITY.

The Details of Mechanical Design

The FUTURITY mechanism uses ten-stop reels containing twenty symbols per reel. The stopping symbols for the *N* machine alternate with the stopping symbols for the *C* machine. Thus when the mechanism is operating in the *N*-mode, the ten stopping positions correspond to one set of symbols; and when operating in the *C*-mode, the alternate 10 stopping positions correspond to the other ten symbols.

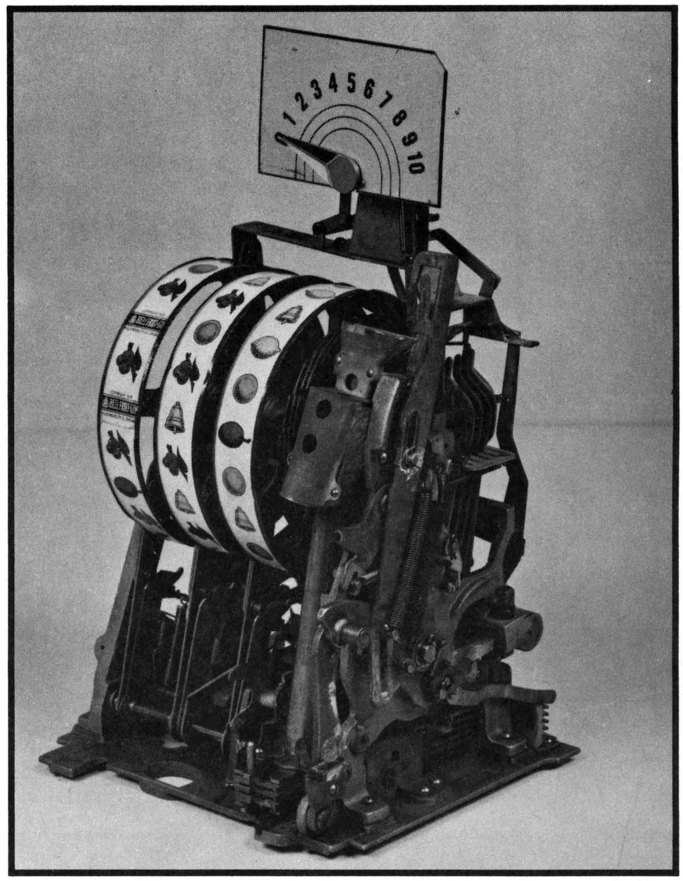


Figure F.3

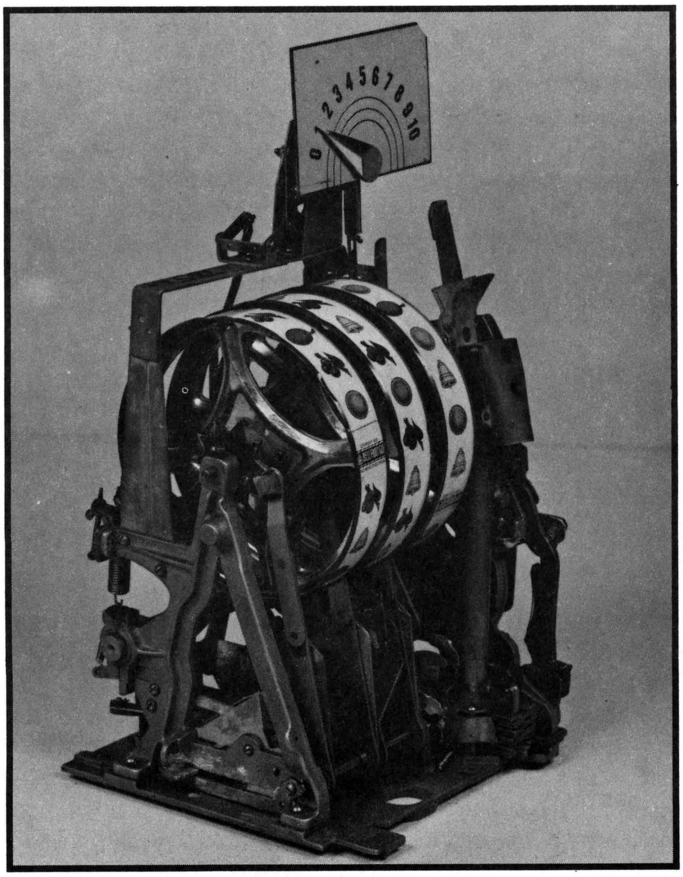


Figure F.2

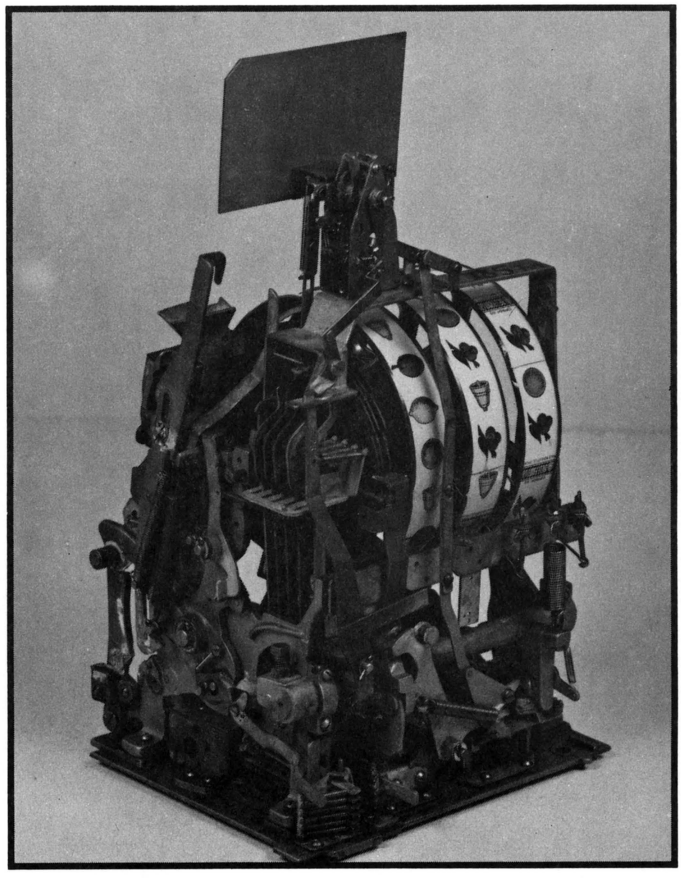


Figure F.4

The ability to change from one set of ten symbols to another alternating set of symbols is achieved by changing the length of the reel stop levers themselves to a length corresponding to one reel symbol, measured on the reel's periphery (arc). In other words, the reel is rotated 18° or 1/20 of a turn. Another way of understanding this change of reel symbols is to note that the effect is the same as changing the payout line, either up or down, by one symbol.

The actual manner in which this changing between the *N* and *C* symbols by altering the stop lever lengths will be shown and explained in detail later in this appendix.

The length of the reel stop levers are changed automatically by the machine itself as a function of the number of coins played during one cycle (ten plays) of the FUTURITY's pointer assembly. The automatic, mechanical programming of the reel stop levers' length is an integral part of the internal mechanical design of the FUTURITY feature itself. The programming is accomplished by indexing a cam each time the machine is played; the node height of the cam determines the reel stop levers' length (for machine *N* or *C*) for that play of the machine.

The indexing of the pointer from 1 to 10 is straightforward and will be covered later in this appendix. The resetting of the pointer upon reaching 10 (thus duplicating an orange payout of ten coins), or any other winning combination, will also be explained.

The FUTURITY Mechanism Exposed

Figures F.2 and F.3 show the front-right and front-left views of the FUTURITY mechanism removed from the case; Figure F.4 shows a rear-right view. Ignoring the dial/pointer assembly, the most outstanding feature of the mechanism, considering the machine's year of introduction, is that the reels use 10-stop star wheels rather than the 20-stop style, *i.e.*, the 1933 MYSTERY "Castle Front" and 1937 CHERRY "Bursting Cherry," which were currently in production.

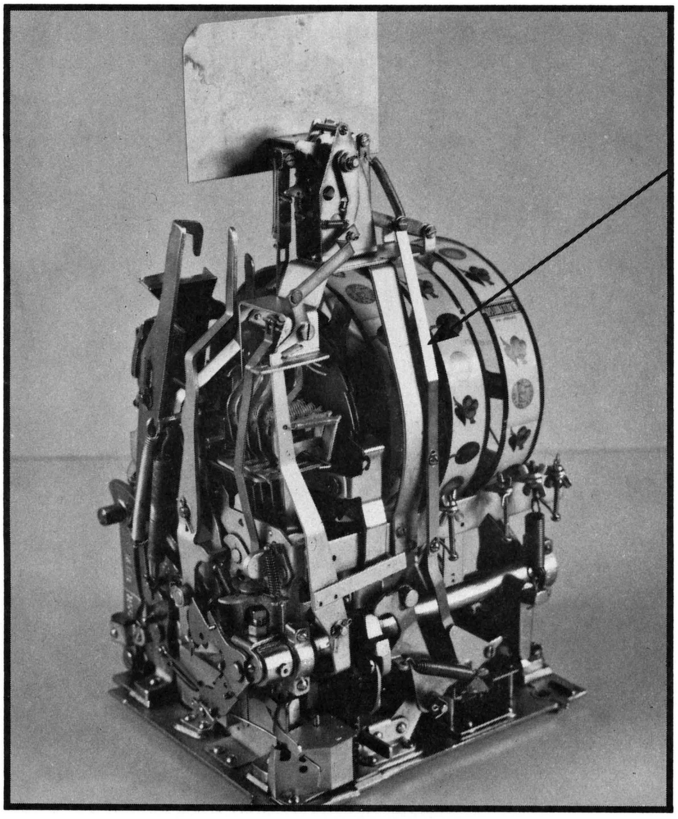


Figure F.5

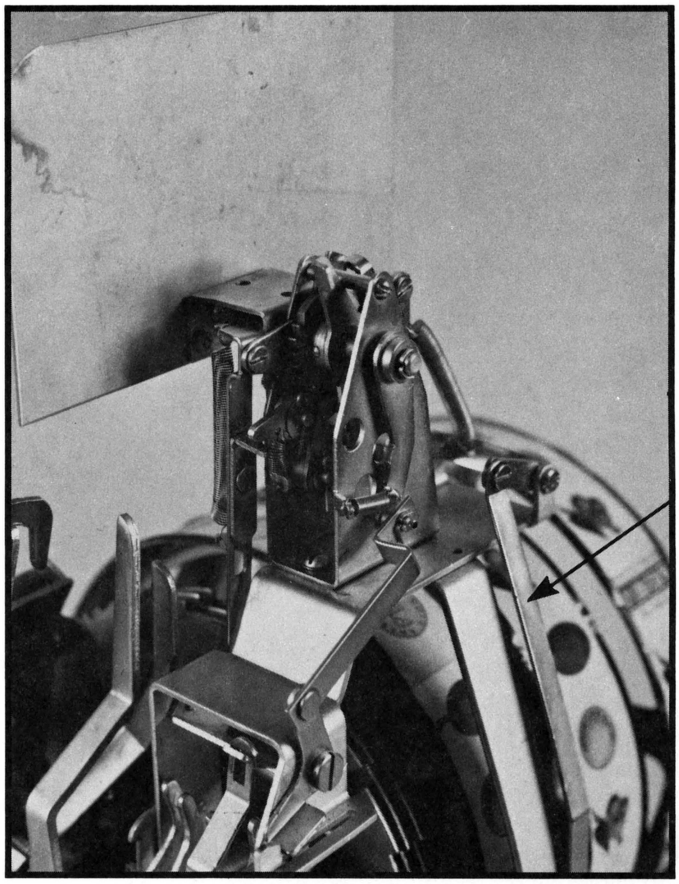


Figure F.6

It should be recalled that Mills introduced new life into their gooseneck line of machines in the late 1920s by introducing the jackpot and the change to "designer fronts," such as the "Lion's Head," and the "War Eagle." But by 1935, 20-stop, escalator-type machines had effectively replaced the older 10-stop, gooseneck styles; so the reasons why Mills introduced the FUTURITY can only be conjectured. Perhaps the Mills Novelty Company had an over abundance of gooseneck, 10-stop parts. The basic new concept of the FUTURITY *required* a 10-stop, 20-symbol mechanism for its implementation.

When Mills introduced their BONUS "Horse Head" machine in 1937 they used the major cheating functions of the FUTURITY in what seemed to be a design paradox. It is reasonably clear that the concept of the BONUS does not require elaborate cheating and is based upon a similar but entirely different principal. The BONUS's bonus feature unequivocally increases the player's odds the longer he plays the machine providing the basis for longer playing times by each player. Perhaps the shortage of FUTURITY parts led to the early days of the BONUS

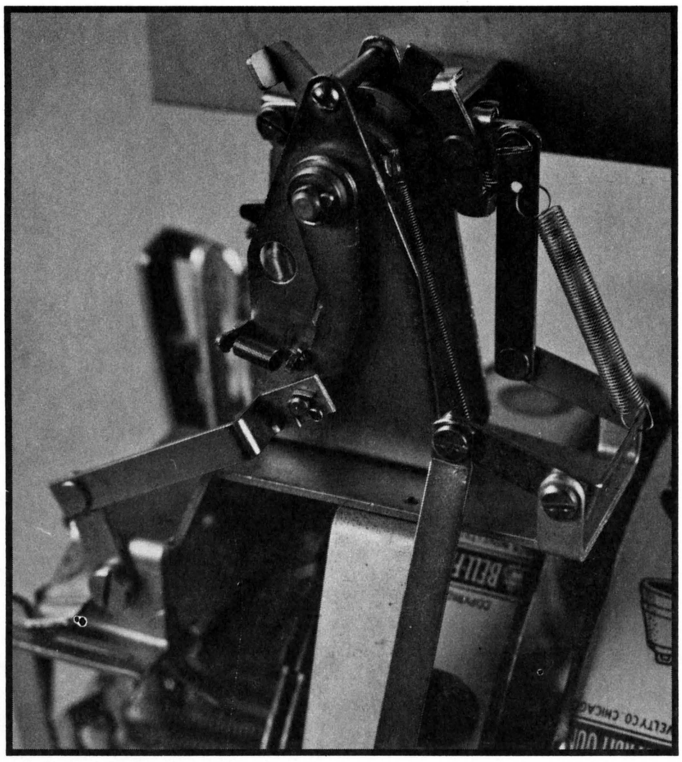


Figure F.7

"Horse Head" especially since its continued success led to an updated version (the NEW BONUS) using then-current technology.

Operation of the Pointer

One of the functions of the pointer assembly is to keep track of the number of plays (machine cycles) since the last winner. The stepping of the index assembly is accomplished by the vertical movement of the pull-bar

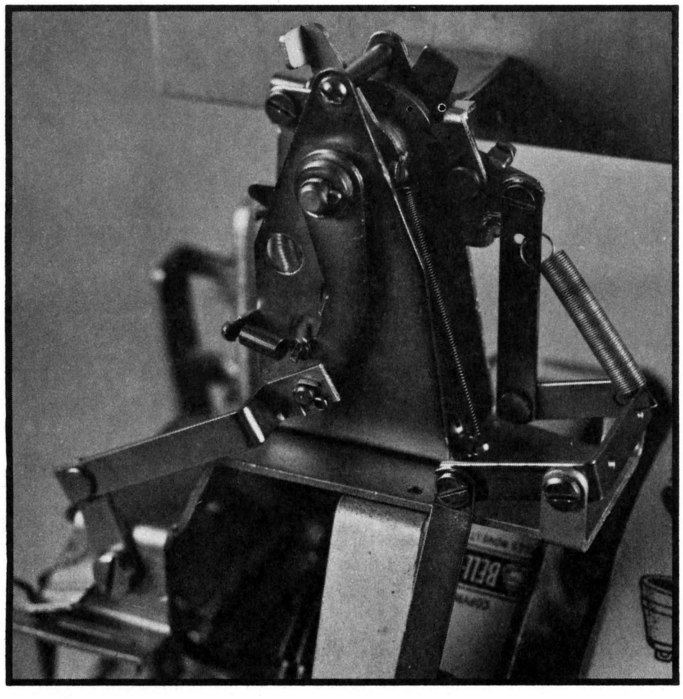


Figure F.8

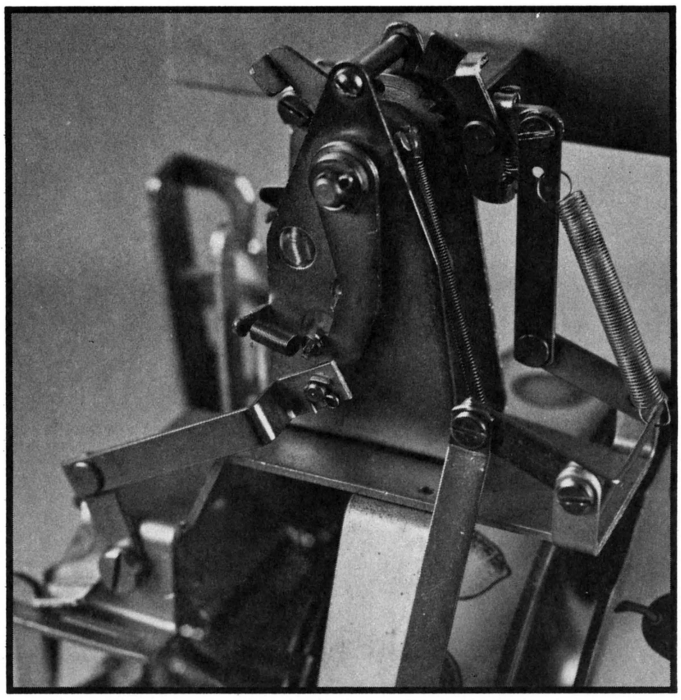


Figure F.9

linkage on the back of the mechanism, shown by the arrow in Figures F.5 and F.6. The linkage runs from the main timing lever at the rear of the machine up to the indexing unit, shown in Figure F.6. When the machine is cycled, the main pull bar moves downward during the wind-up phase of the machine from its rest position as shown in Figure F.7 to its full downward position as shown in Figure F.8. Note that the pawl engages the ratchet notch on the index cam at the bottom of the stroke, shown in Figure F.8; as the machine unwinds, the upward motion of the linkage bar causes the index cam to rotate

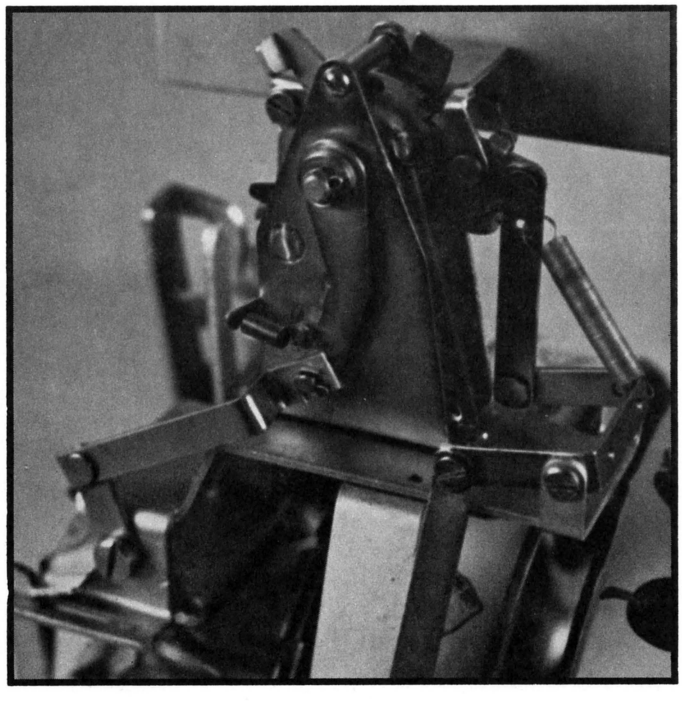


Figure F.10

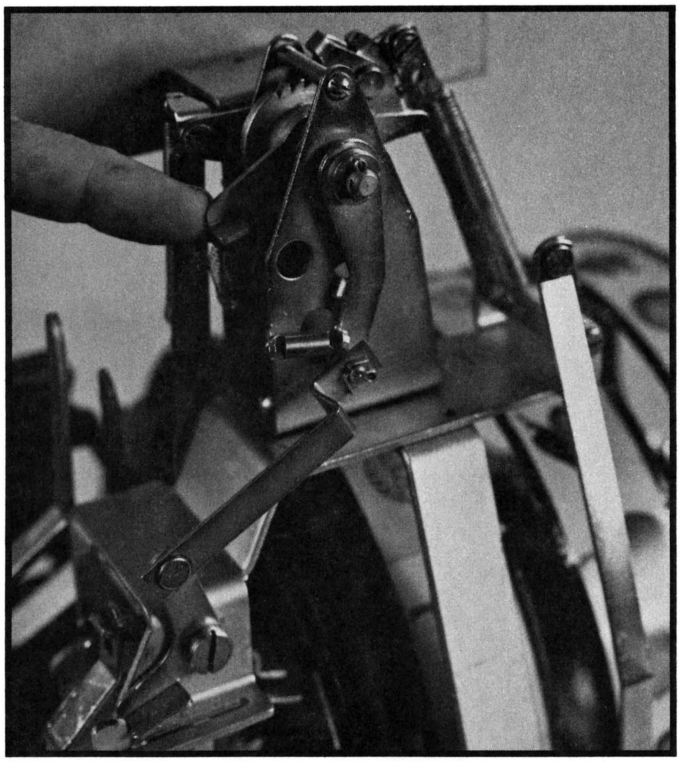


Figure F.11

counterclockwise to its new position, shown in Figure F.10. Comparison of ratchet position in Figures F.8 and F.9 show its movement—difficult to show in still photographs. Close inspection of Figure F.10 reveals that the second ratchet notch on the index cam has been engaged, indicating another play of the machine.

This process of indexing the pointer ratchet, one notch at a time, continues until either the pointer reaches 10 on the dial or there is a winning combination. At the occurrence of either event, the pointer reset lever is activated as shown in Figure F.11 (see finger position).

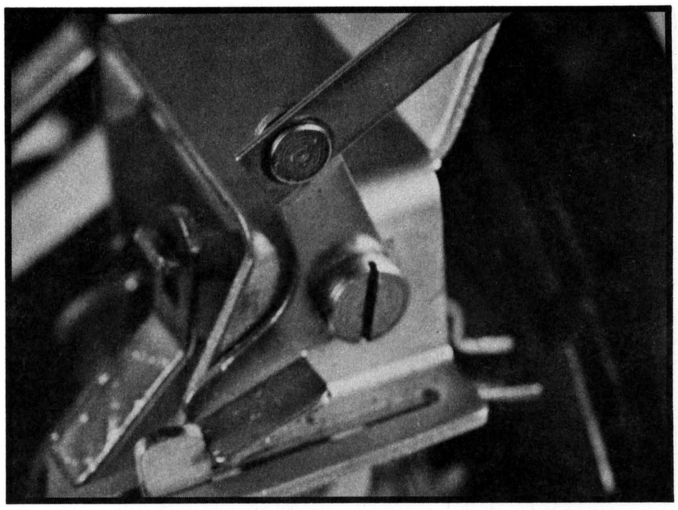


Figure F.13

Figure F.12 shows the index unit just as the pointer has reached 10, as indicated by the finger. While the pointer is being reset to 0 by its wind-up spring, an additional linkage is being activated by the index assembly as shown in Figure F.13. The link bar rotates the bell crank, as shown in Figure F.14 (just above the finger), and releases the payout lever shown in Figure F.15 by the pointing finger, the hand simulating the motion of the payout lever, a payout of three oranges as shown in Figure F.16.

Figure F.17 shows an additional linkage bar coupling the indexing assembly to a plate which rests above the top of the upper payout levers. Each time one of the payout levers travels to a forward position it will automatically make contact with the plate and cause it to rotate

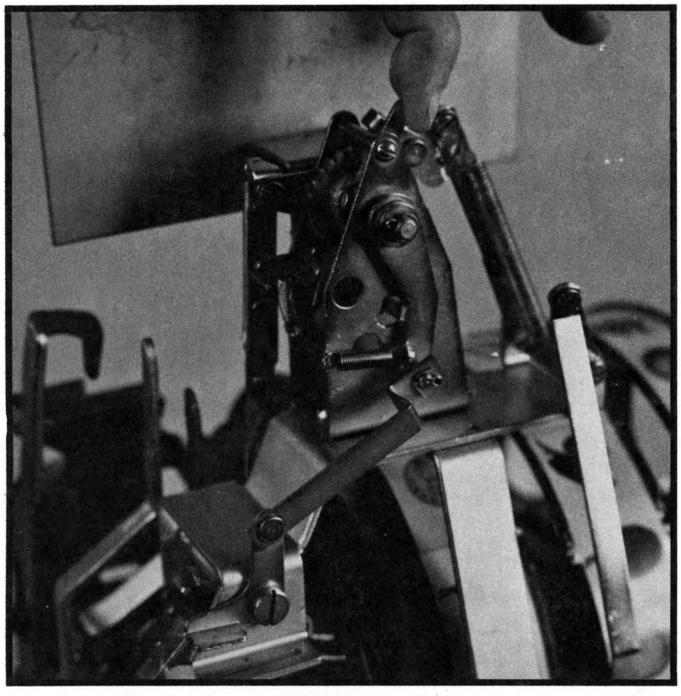


Figure F.12

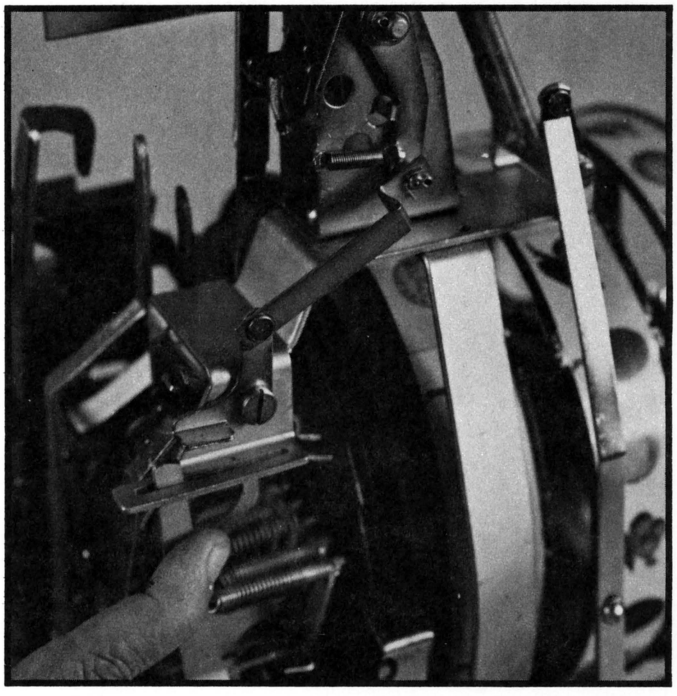


Figure F.14

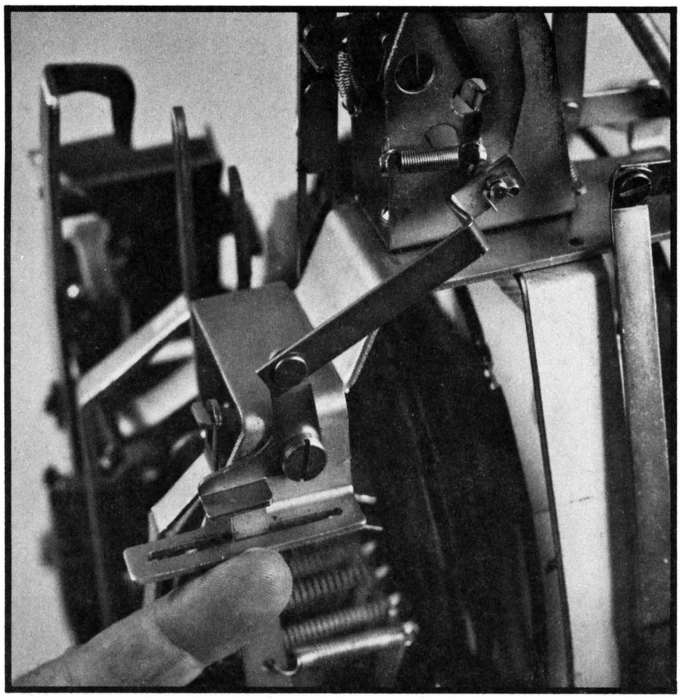


Figure F.15

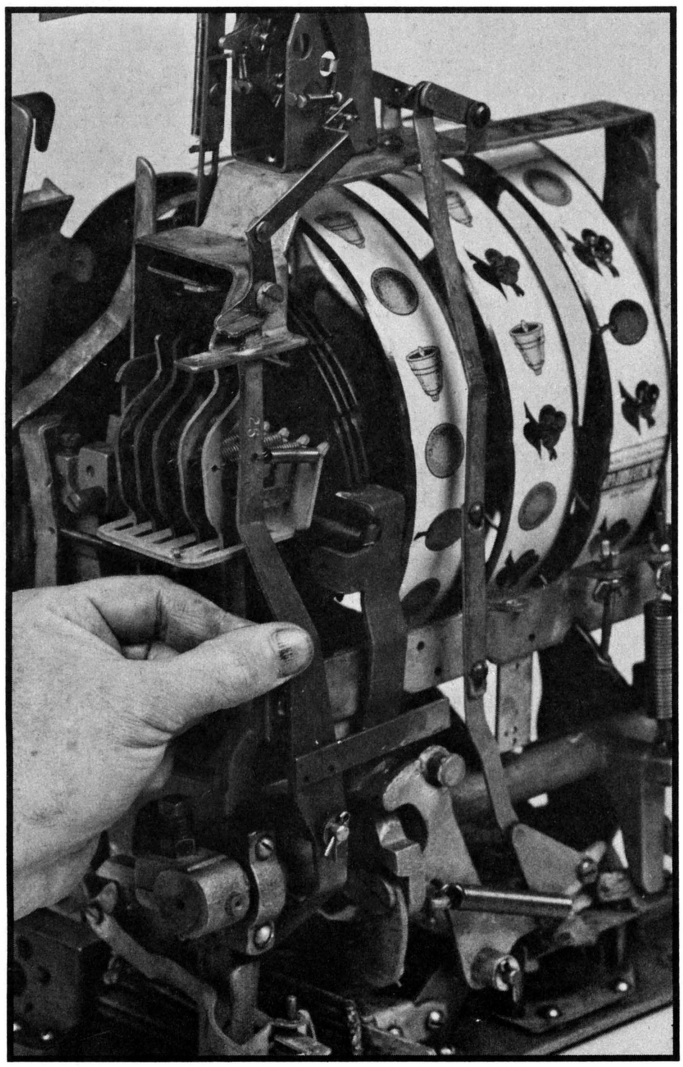


Figure F.16

in such a manner that it forces the linkage, by its upward movement, to reset the index assembly to its zero position; the pointer thus returns to 0 on the dial.

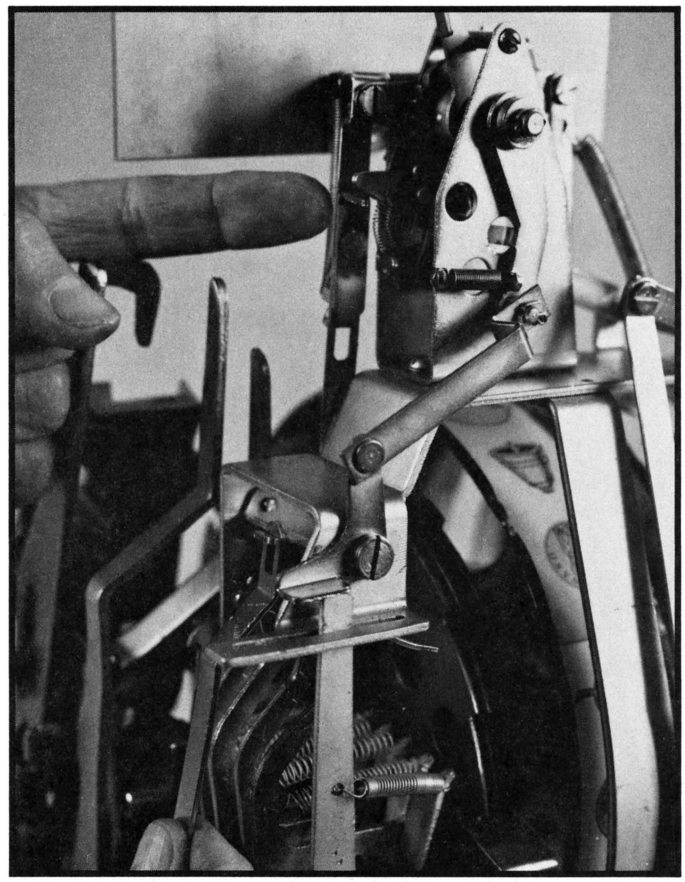


Figure F.17

Implementation and Control of Operation of the Reel Stopping Positions

As mentioned previously, the selection of which set of 10-stop reels (and their corresponding set of symbols) are being used is determined by changing the length of the reel stop levers. Figure F.18 shows the short length configuration of the reel stop levers corresponding to the *C* mode of operation. Figure F.19 shows the long reel stop lever configuration corresponding the *N* mode of operation.

The control of the length of the stop levers is governed by a ten-position cam housed on the left side of the machine, indicated by Arrow A in Figure F.20. Each time the machine is cycled, the cam is rotated 36° by the link shown by Arrow B in Figure F.20. Riding on top of the cam is a control lever as shown by Arrow C in Figure F.20, which normally keeps the reel stop levers at their maximum length. When the cam is rotated to a detent position, the control lever moves downward in such a way as to allow the reel stop levers to assume their shorter length as was shown in Figure F.18. Figures F.21 and F.22 show the manner in which the control lever shortens the effective length of the reel stop levers, Figure F.21 showing the shorter (or *C* mode) effective

length, Figure F.22 showing the longer (or *N* mode) effective length.

On a typical cam, there will be eight high stops corresponding to a long stop lever and two detents corresponding to a short stop lever. Each time the machine is cycled—regardless of the outcome—the cam is rotated one step (36°), and thus repeats its pattern every 10 cycles. Mills made several cams for the FUTURITY,

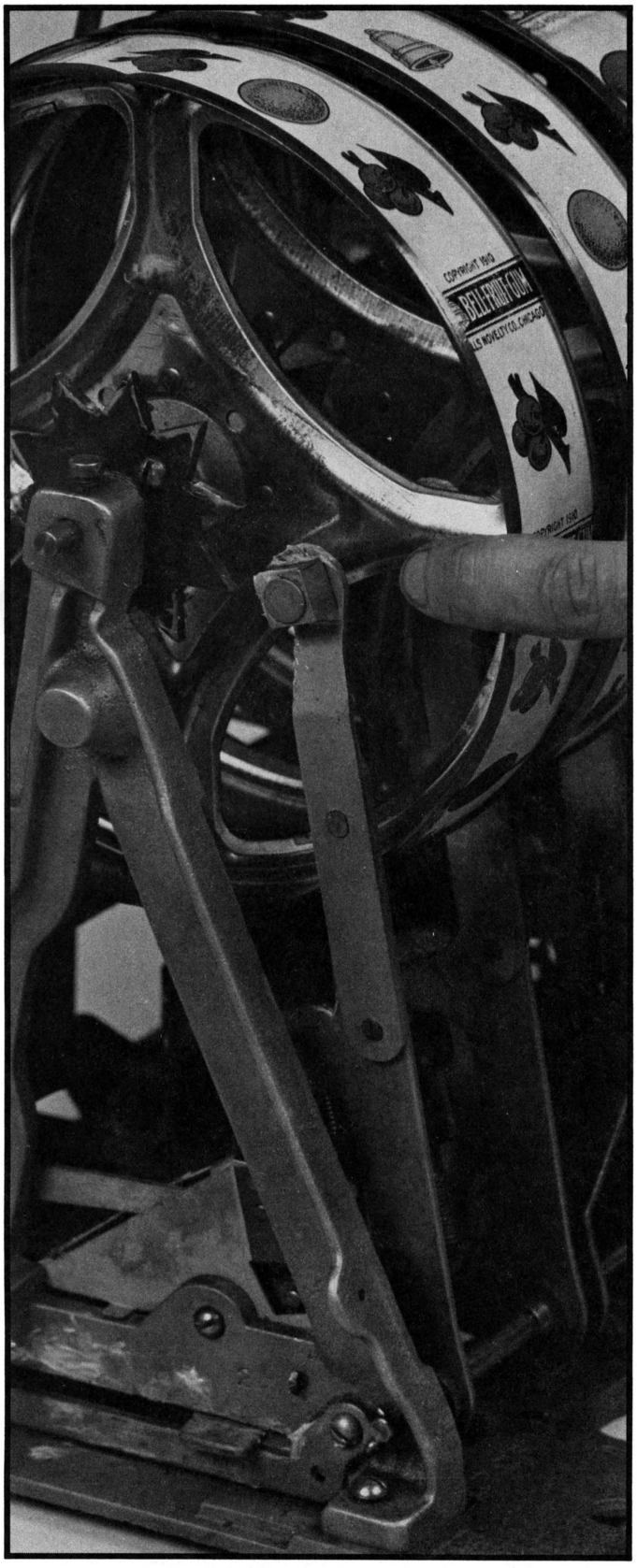


Figure F.18

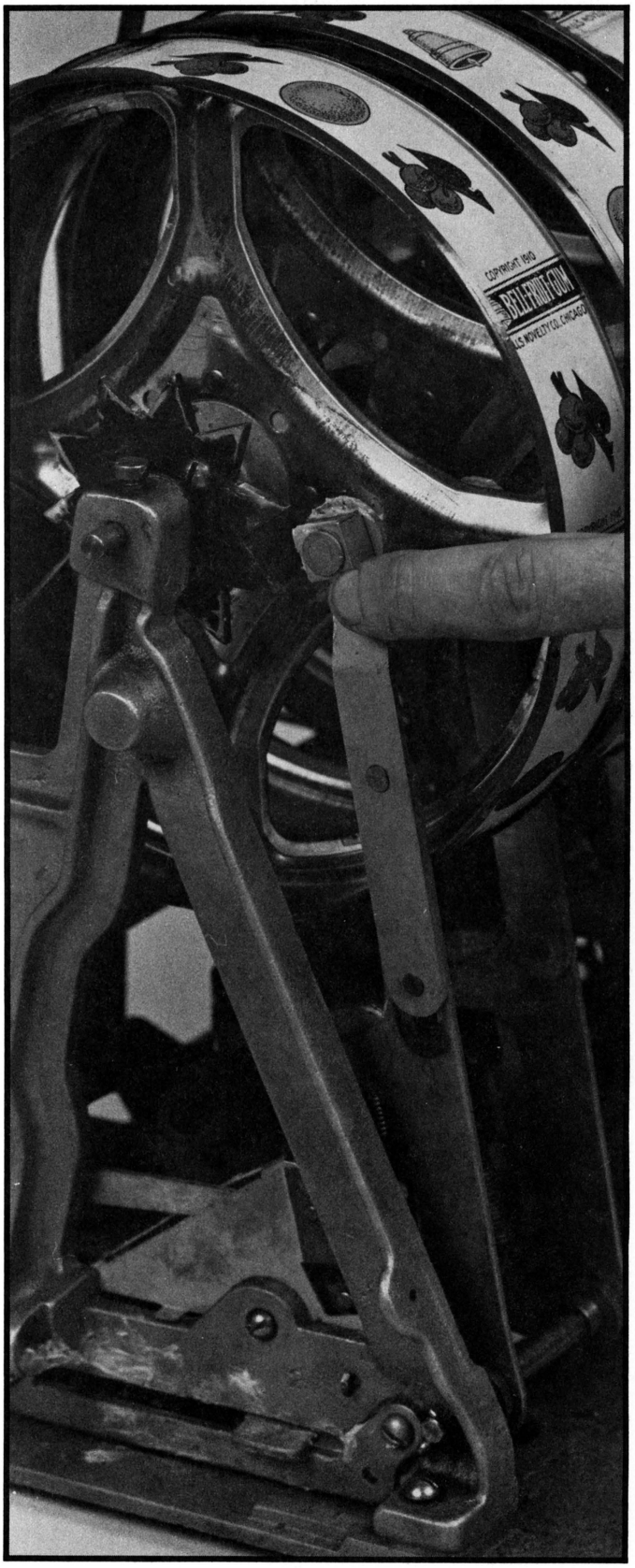


Figure F.19

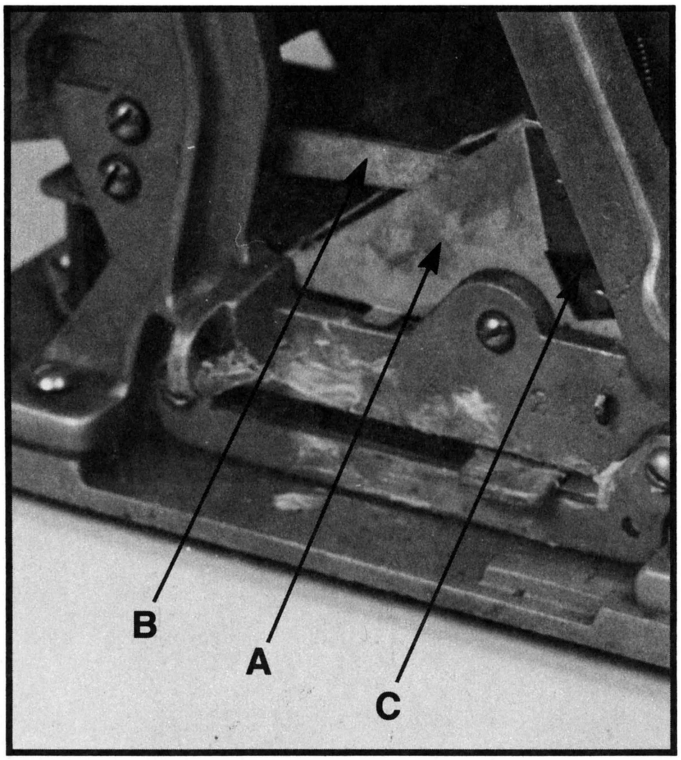


Figure F.20

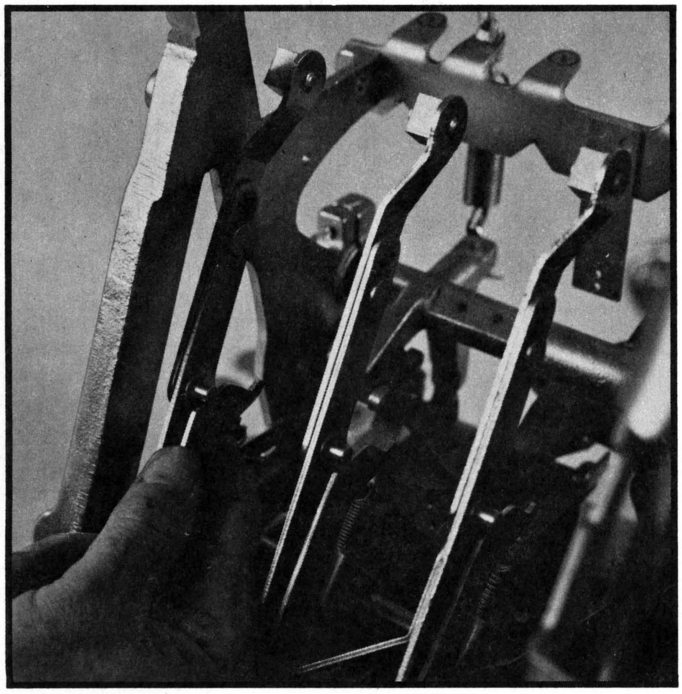


Figure F.21

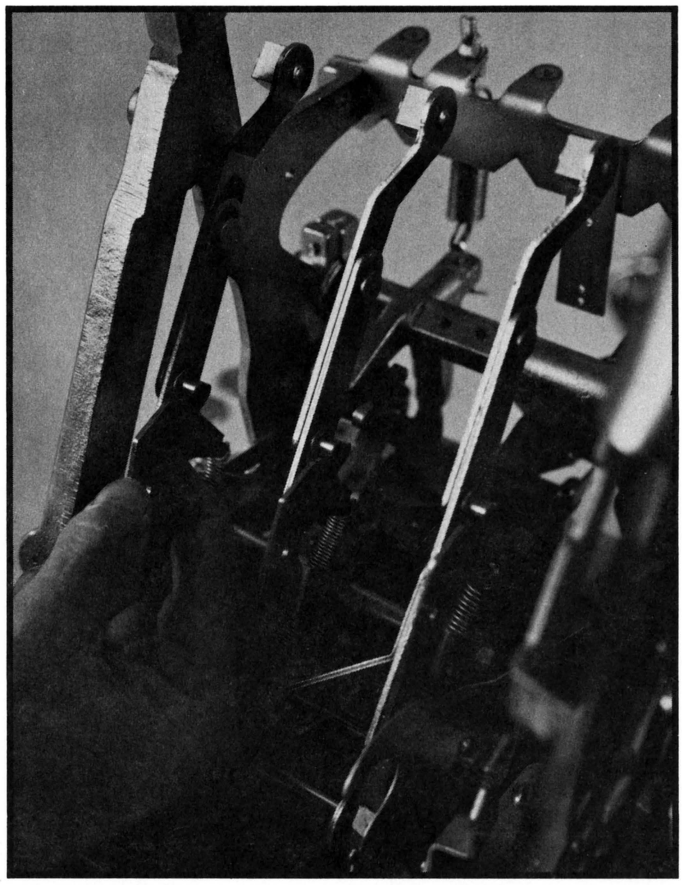


Figure F.22

and the ratio and position of detent to normal positions would allow the operator to adjust the odds of the machine with the cam rather than by changing the reel assembly.

References and Analysis

Loose Change magazine published a two-part article about the Mills FUTURITY bell machine in the January and April issues of 1980, Part I and Part II respectively. These articles provided, for the first time, a detailed analysis of the performance statistics and odds of the FUTURITY machine by utilizing extensive computer runs to simulate the various random processes involved. It is very unlikely the inventors of the FUTURITY feature could have performed the detailed analysis that is now possible with high speed computers. Their instincts and ingenuity served them well enough to produce this remarkable game which continues, to this day, to deceive collectors and defy complete statistical analysis.

G The BONUS Family

Introduction

The Mills BONUS slot machine was first introduced in 1937, built on a Mills FUTURITY mechanism. It was reintroduced in a "simplified" version in 1939 (minus the FUTURITY's reel-shifting feature) as the NEW BONUS. The design of cabinet, as shown in Figure G.1, led to the nickname, "Horse Head" BONUS. After World War II, in 1948, Mills reintroduced the BONUS slot machine in a modified "Hi Top" cabinet, shown in Figure G.2; this version was quickly dubbed, "Hi Top" BONUS. And

Figure G.1

Figure G.2

it was manufactured as late as 1952 by Mills' Bell-O-Matic division, still as a "Hi Top." The machine will be referred to as the BONUS machine—meaning all models—for the purpose of this appendix.

The basic concept of the Mills BONUS slot machine was to reward the player with a *bonus payoff* when a particular feat was accomplished during a session of play.

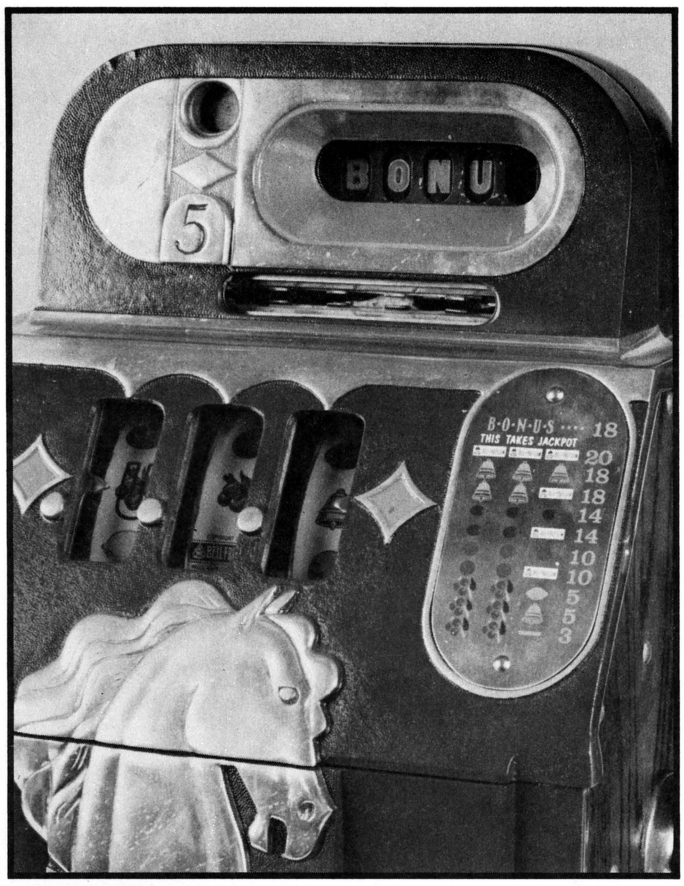


Figure G.3

Since the bonus feat required a prolonged period of playing time, it was hoped that the player would continue to play the machine more than usual in order to accomplish the feat.

The bonus feature for the Mills BONUS slot machine required the spelling of the word "B-O-N-U-S" in proper sequence. Whenever the first reel stopped on the next letter of the word, the corresponding letter signal—a flip-up tab-–would appear in the annunciator (the letter display unit) at the top of the slot machine. Referring to Figure G.3, it can be seen that the first reel has stopped on the "U" (the B-O-N-U-S letters were superimposed on the standard reel symbols, since the bonus feature did not affect the normal operation of the slot machine). Further inspection shows that the corresponding "U" signal has been flipped up in the annunciator, indicating the "U" has been achieved or *made*; the next letter the player needs is the "S".

When the "S" is made, the Mills BONUS will deliver a bonus payout of 18 coins—the same as the payout for three bells. The "S" was always superimposed on a lemon so as not to be in conflict with the regular payouts of the machine. The annunciator would be automatically reset with no letters showing, and the task of spelling "B-O-N-U-S" began again with the "B" being the first letter required.

The BONUS Slot Machine Exposed

Figures G.4 and G.5 show the mechanism as viewed the right-hand-front side and the right-hand-rear side; the coin tube assembly has been removed in order to show the right end of the reel assembly.

It is readily apparent that the basic mechanism is a standard Mills 20-stop, escalator-type slot machine. The bonus feature has been literally strapped onto the top, rear, and right hand side of the mechanism.

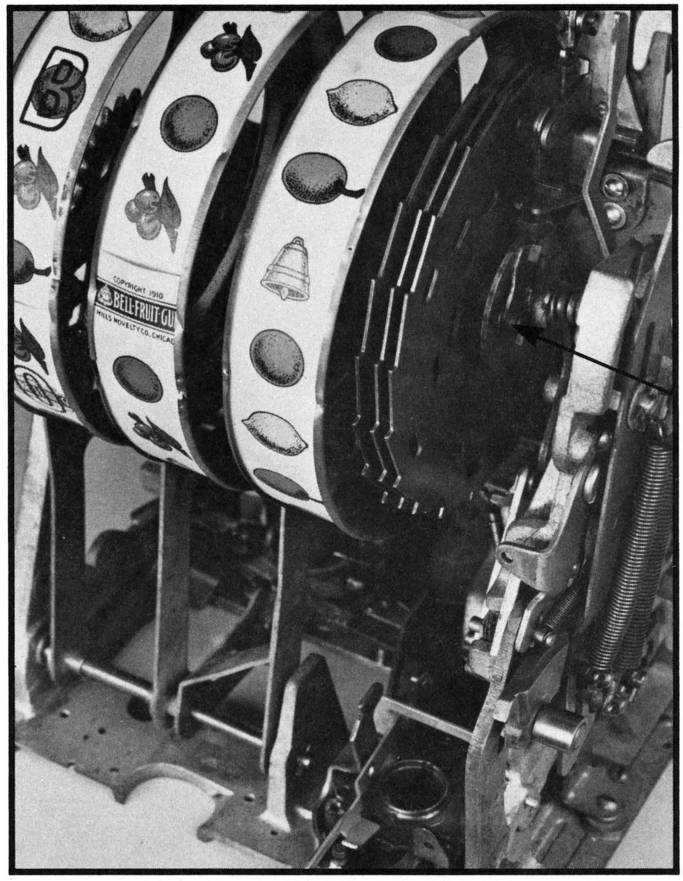


Figure G.4

The BONUS's bonus feature is driven by the linkage from the timing lever as shown by Arrow A in Figure G.5. The determination of the first reel letter is done by sensing the sprocket assembly which has been added to the reel assembly as shown by the arrow in Figure G.4

When the word "B-O-N-U-S" has been completed, the annunciator resets the letter signals. The lever shown by Arrow B in Figure G.5 is simultaneously activated and its action duplicates the presence of three bells on the payout line.

While the BONUS mechanism is relatively simple, the annunciator and sprocket require constant attention to keep them clean and properly lubricated. The allowable tolerance (variance) in the length of the linkages is fairly small; as a result, they require frequent adjustment to insure proper operation. Once the theory of operation of the BONUS mechanism is understood, it is a routine matter to keep it in proper operating order.

Unfortunately, the uniqueness of the bonus feature combined with no technical literature, has led many collectors (and operators of yesteryear) to shy away from

this device. To many collectors, the bonus feature is just another thing that can and will go wrong. But the small investment in time to understand this novel feature can provide the collector with an interesting feature that significantly enhances the play of the standard slot machine.

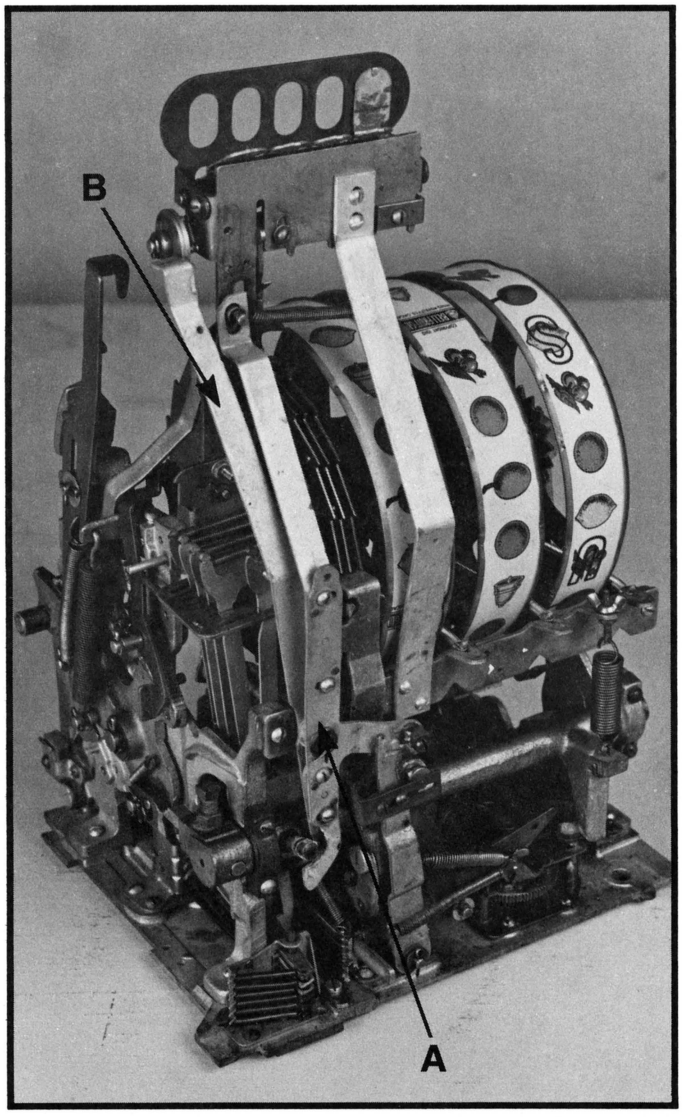


Figure G.5

Letter Sensing: The Theory of Operation

The BONUS annunciator assembly serves as the *traffic cop* for the bonus feature. The assembly mechanically records and displays the B-O-N-U-S letters as they are successfully made. When the word "BONUS" has been completed, the annunciator permits the BONUS slot machine to make the 18-coin bonus payout.

The starting point for the operation of the bonus feature is the sensing and signaling the success of achieving the current letter required to spell B-O-N-U-S. This function is accomplished by the special sprocket assembly shown in Figure G.6. It should be noted that not only must the *current* letter be properly sensed, but the *next letter in sequence* must also be determined. It is essential that the

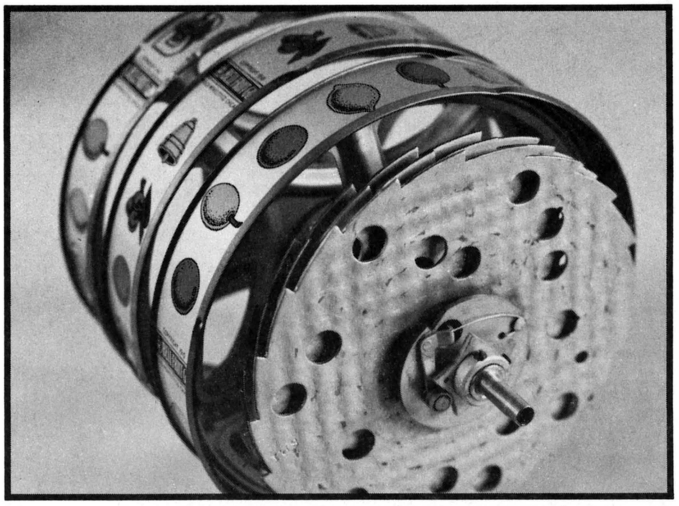


Figure G.6

operation of this sprocket assembly be understood in order to set the timing of the bonus feature as well as to diagnose problems with the feature unit.

The sprocket assembly consists of five basic parts: the cusp; an idler disk; a bearing lever; and a small flat spring (it's round, actually). The five-lobe, star-shaped cusp disk is firmly fastened to the first reel disk (hence, the first reel) via the concentric first-reel shaft. Recall that the first reel disk is the one which is in full view. The letters, B, O, N, U, S, are equally spaced four symbols apart on the first reel and appear in proper spelling order when viewed from top to bottom.

Each of the five cusps shown in Figure G.7 correspond to a specific letter. Arrow A is pointing to the cusp which corresponds to the "B" in "B-O-N-U-S." Referring again to Figure G.7, also note the idler disk (Arrow B) which is free to rotate about the reel shaft. Because of the action

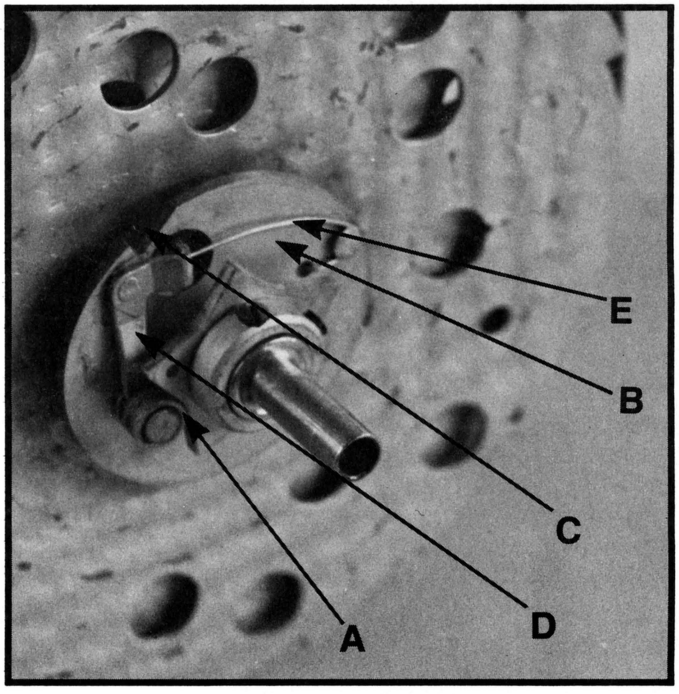


Figure G.7

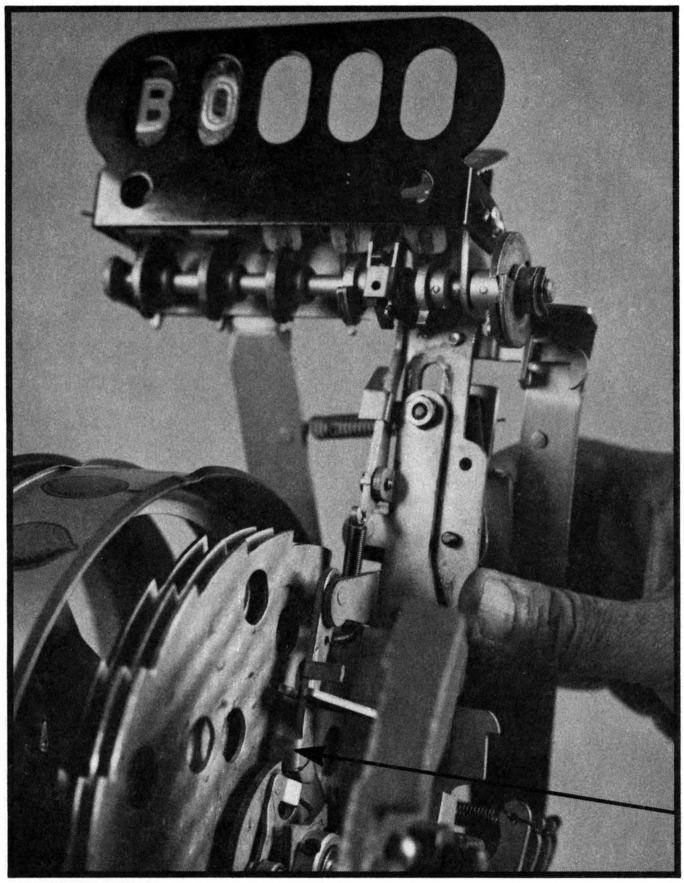


Figure G.8

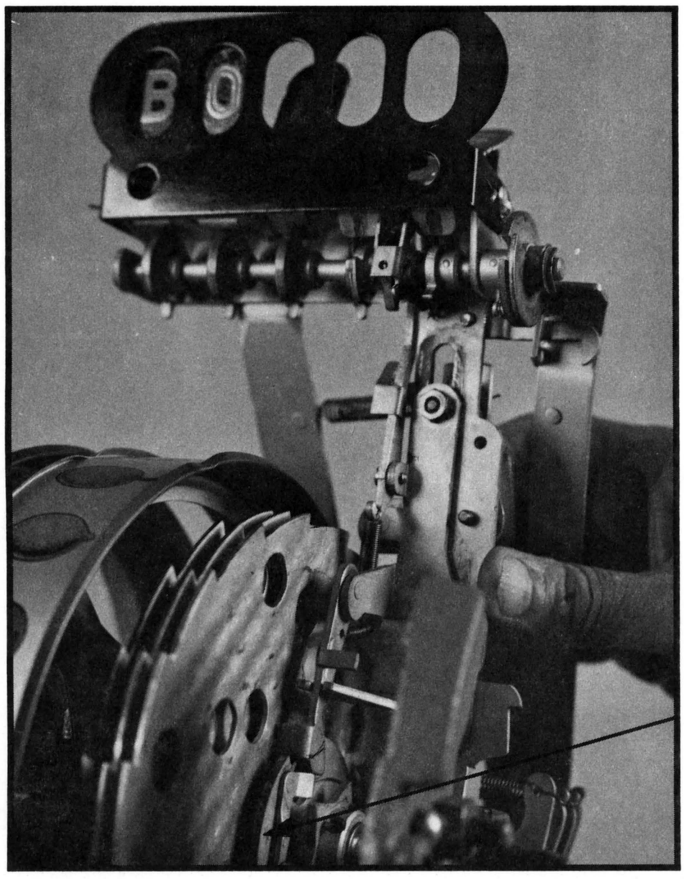


Figure G.9

of the spring-loaded bearing lever, it will come to rest at one of five positions as dictated by the star-shaped cusp disc.

Continuing with Figure G.7, the roller bearing of the bearing lever on the idler disc is currently at the bottom of the cusp corresponding to the letter "B." Moreover, the notch, indicated by Arrow C, is approximately in line with the letter "B" on the first reel. Thus the five possible resting positions for the idler disk will position its notch in line for the five B-O-N-U-S letters on the first reel. Because of the physical location of the notch sensing linkage with respect to the payout line, the notch on the idler disc is always positioned in line with the current letter which is being sought.

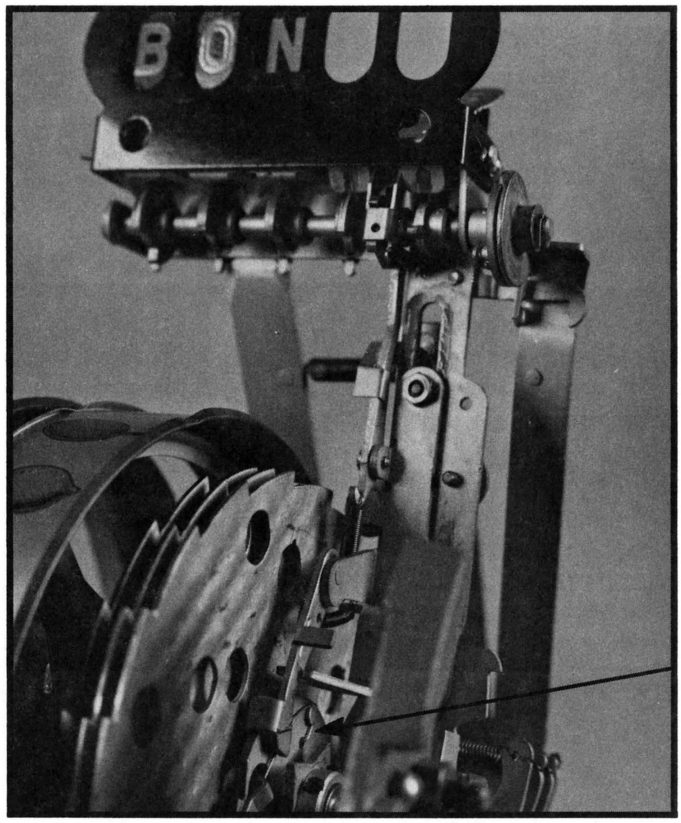


Figure G.10

It is the sensing of the idler notch at the correct place by the annunciator sensing lever shown by the arrow in Figure G.8 that causes the annunciator to index to the next letter (or pay the bonus). After the idler disc notch has been properly sensed, the sensing lever continues to travel downward. This downward motion causes the idler disc to rotate to the next cusp as shown by the arrows in Figures G.9 and G.10.

The end result of rotating the idler disc notch to its next rest position, seen in Figure G.10, automatically positions it to correspond to the next letter to be made. Thus the notch on the idler disc must be positioned to correspond to the same letter that the annunciator has been indexed to expect next. In other words, if the idler disc notch is not in synchronization with the annunciator, the sensing of the notch will occur on a different letter

than the annunciator has been indexed to display—a common problem, but so easy to fix! How? Simply by manually rotating the idler disk so its notch corresponds to the current letter being sought. For example, if the annunciator is showing B-O-N, set the idler disk notch to be in alignment with the letter "U."

The Theory of Operation of the The Annunciator

The annunciator is operated by the rotation of the index shaft, located several inches below the signal windows as shown by the arrows in Figure G.11. The index shaft is sequentially rotated to one of five rest (or indexed) positions. The five rest positions correspond to the five bonus letters: B, O, N, U, S. The "S" or fifth position is also the reset state, indicating that no letters are currently available (sometimes referred to as reset *after* the bonus payout), even though it is entered into when the fifth letter is achieved.

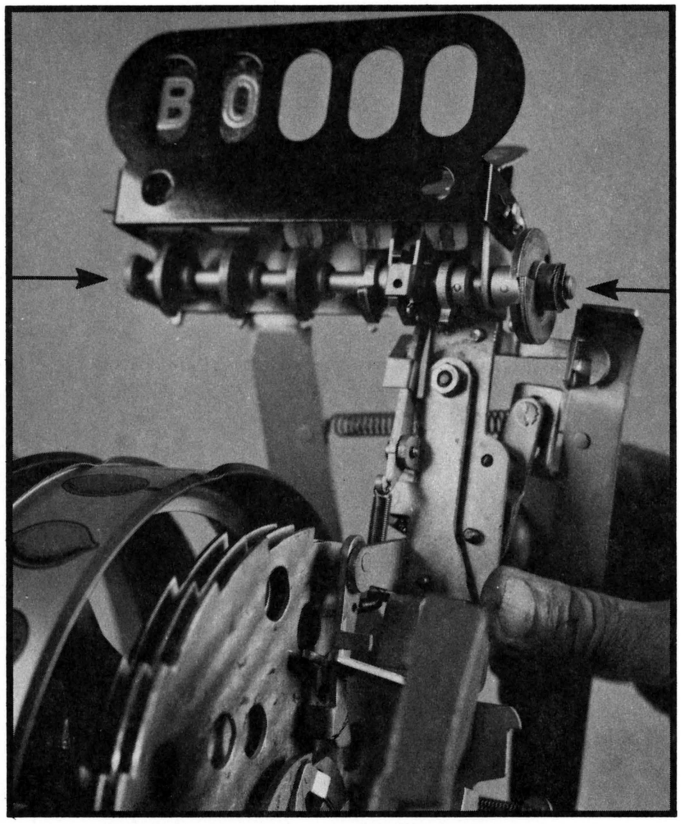


Figure G.11

Referring again to Figure G.11, the five cams—one under each signal letter—control the position of the signal letters for viewing. The two cams located on the far right end of the shaft control the bonus payout. The cam located between the "U" and "S" signal cams operates the index cam lever, which drives the notch sensor and is responsible for the rotation of the index shaft.

Each time the slot machine is cycled, the idler notch sensing linkage is released and attempts to travel downward as shown in Figure G.12. Note that Figure G.12 is a direct view of the notch sensing lever, indicated by Arrow A; the reel assembly has been removed from the

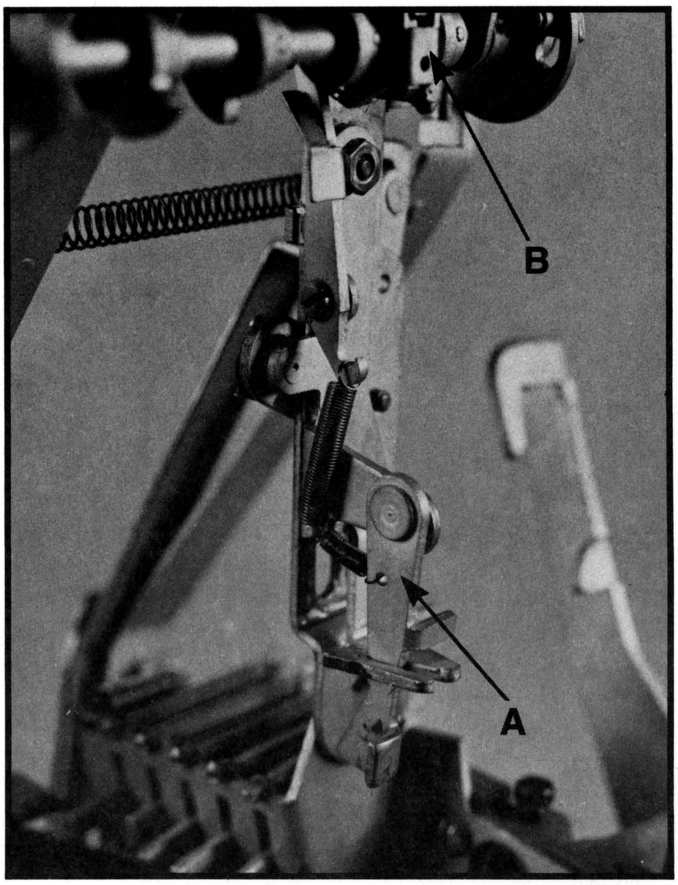


Figure G.12

mechanism for ease in viewing its operation. If the notch is not present under the sensing lever, its travel is not permitted, and the annunciator index shaft does not rotate. If, however, the notch is present, the sensor travels downward, and this motion causes the idler disk and index cam on the index shaft to rotate as shown by Arrow B.

The Operation of the Bonus Payout and Resetting: The Theory of Operation

When the "S" is sensed by the notch sensing linkage, the annunciator momentarily appears as shown in Figure G.13. The timing of the payout of the bonus is such that the "S" signal never really has time to be fully exposed. The bonus payout sensing lever attempts to pass through the two bonus cams each time the machine is cycled, as shown in Figure G.14. Figure G.15 shows the linkage of the bonus sensing payout lever retracted from the bonus cams during the wind-up phase of the machine. After the reel stop levers have stopped the reels, the bonus payout sensing lever is released as shown in Figure G.16.

As the notch sensing linkage rotates the annunciator index shaft, the inner bonus cam is rotated to a position where the bonus sensing lever can pass through both cams as shown in Figure G.17. The bonus sensing lever, previously shown in Figure G.5, pivots on the slot machine frame such that the portion of the lever below the pivot acts as a payout lever corresponding to the three bells lever (payout of 18 coins).

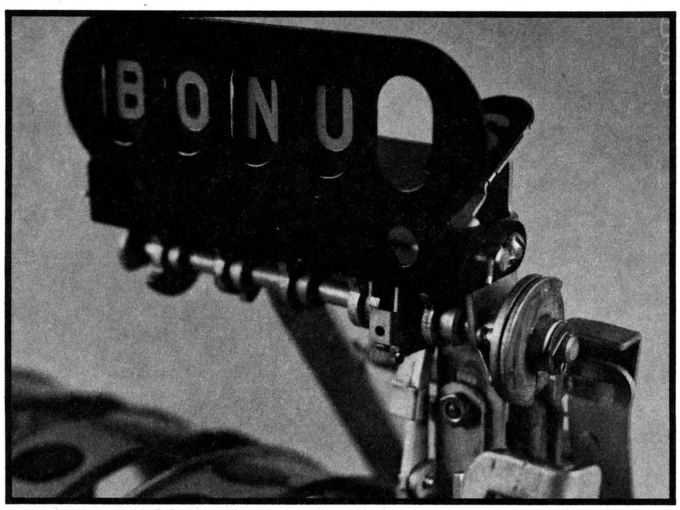


Figure G.13

Concurrently with the B-O-N-U-S payout, the index shaft has been rotated to its reset position corresponding to all letter signals being flipped down as shown in Figure G.18. The next cycle of the slot machine retracts the bonus sensing lever from the bonus cams and the entire bonus assembly is in the reset state waiting for the next occurrence of the "B" on the first reel, Figure G.19.

The timing of the B-O-N-U-S sensing, payout, and resetting happen almost instantly and are reviewed here for clarity:

I. The annunciator indicates B-O-N-U; the reels are stopped with the first reel stopping on the "S."

II. The payout levers are released, causing:

A. The notch sensing linkage to travel downward, causing:

1. The annunciator shaft to rotate, resetting the letter signals, and

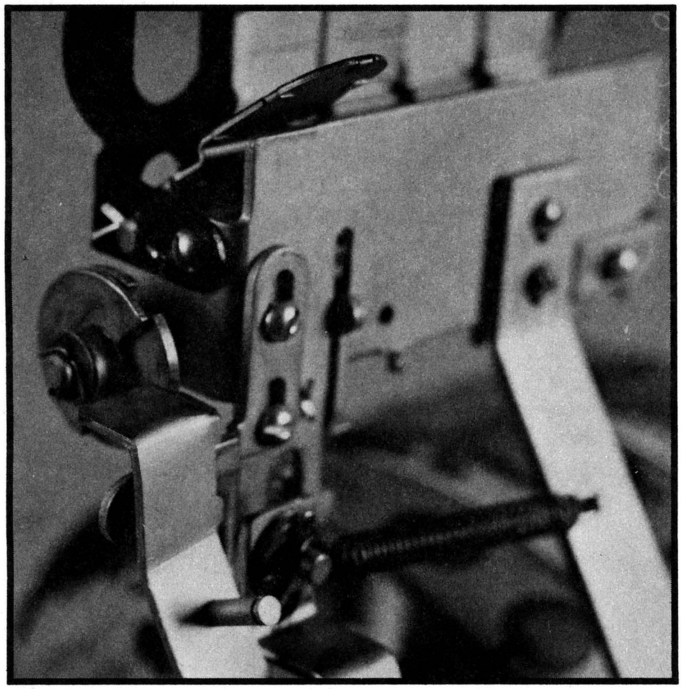


Figure G.14

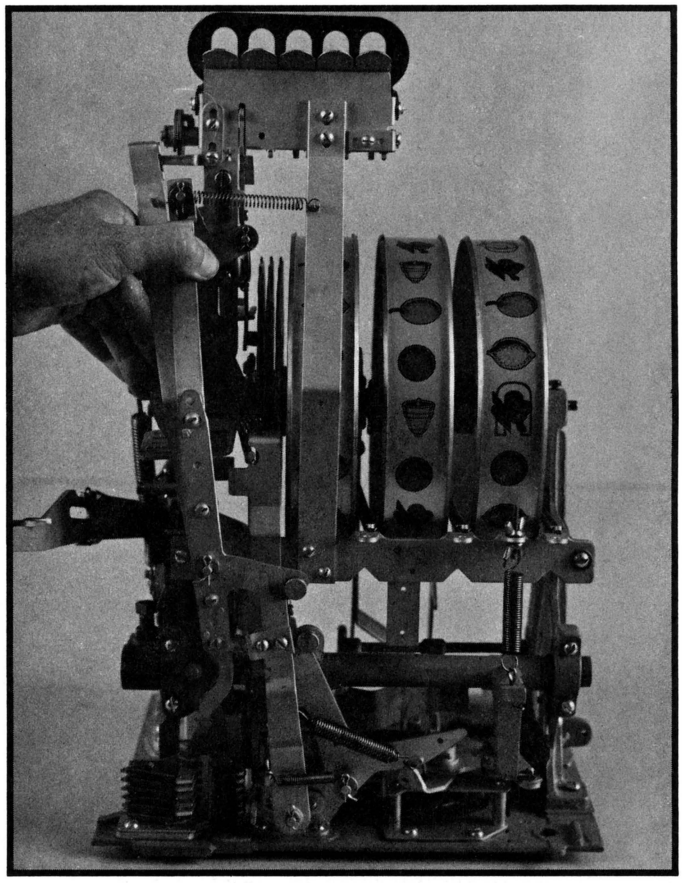


Figure G.15

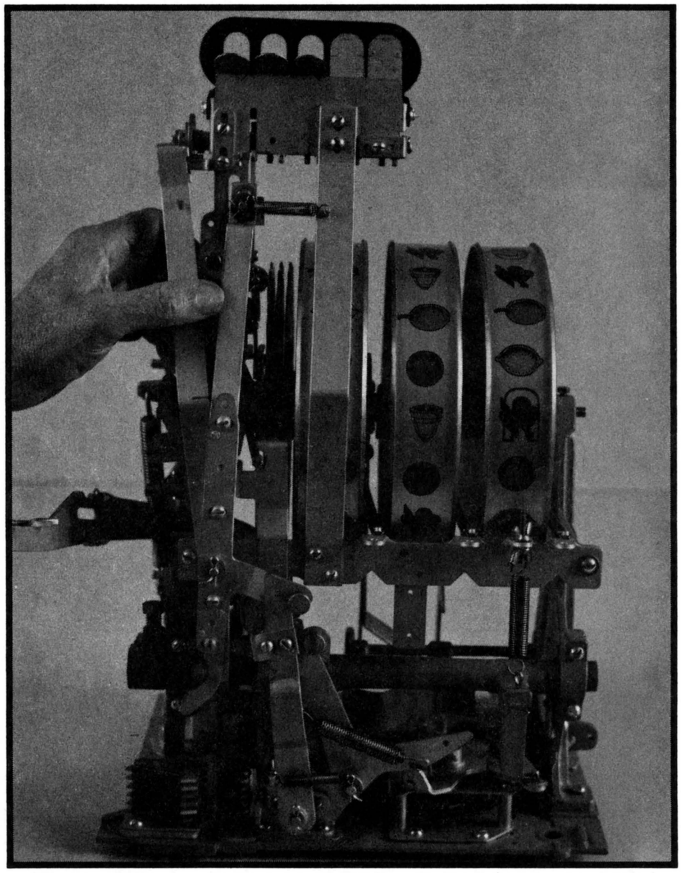


Figure G.16

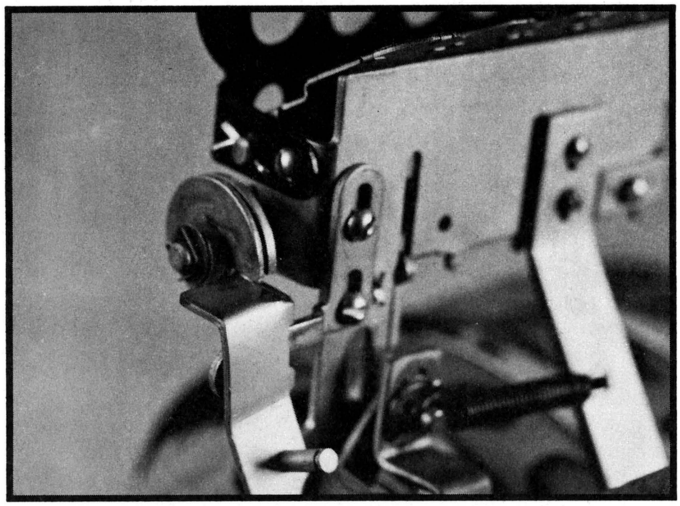


Figure G.17

2. Allowing the bonus sensing lever to permit the payout of three bells, and

3. The allowing of the notched idler cam to rotate to its zero position, where it can again search for a "B."

III. The machine completes its final phase, allowing the payout slides to dispense the bonus payout of 18 coins.

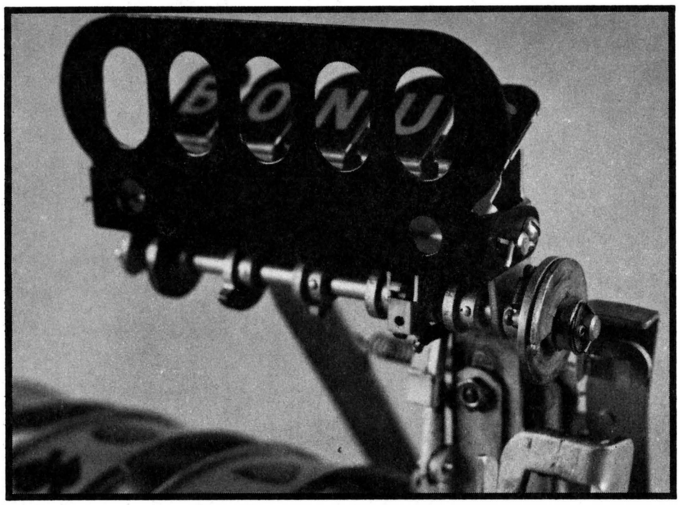


Figure G.18

Adjustments

Despite the complicated appearance of the bonus feature of the BONUS slot machine, adjustments are relatively simple. The adjustment for length of the main operating link (see Arrow A, Figure G.5) can be made by loosening the screws on the lower end of the link; make the required adjustment—either up or down—and tighten the screws.

The sprocket assembly is fastened to the first reel shaft by means of a special collet. It may be necessary to adjust the axial position of the sprocket if it has worked loose; or, if the reel assembly is disassembled, the sprocket assembly must be re-adjusted. Adjustment is made by fastening the sprocket assembly to the shaft such that the notch in the idler disk is in alignment with one of the

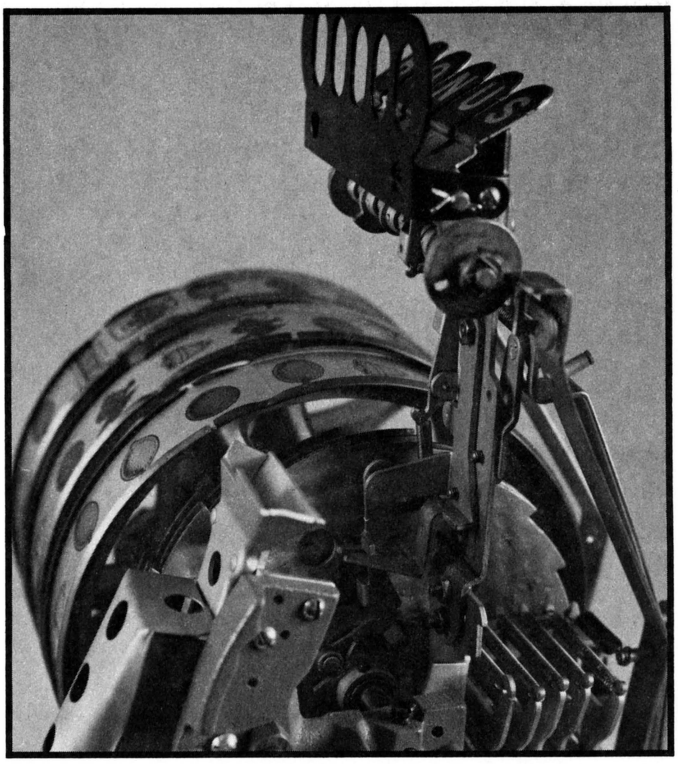


Figure G.19

reel strip letters. Then the idler disk can be sychronized as previously instructed. This adjustment is not an easy one to make. So, do not move the sprocket assembly unless absolutely necessary—in other words . . . if it works, don't fix it!

The bonus payout lever (see Arrow B, Figure G.5) must be adjusted in the same manner as the other vertical payout levers. In the non-pay position, shown in Figure G.5, the lower end should be adjusted to not quite touch the horizontal payout levers. In the payout position, shown in Figure G.17, it must trip all of the horizontal payout levers except for the jackpot (the top horizontal payout lever); its action must duplicate a three-bell pay.

If the signals do not fit closely to their corresponding windows, the tabs on the bottom can be bent slightly to give a proper fit. Take pains, however, to not make them fit too snugly to their windows; a strip of paper should fit between the signal and its corresponding window without any drag whatsoever.

The annunciator assembly may be adjusted to the window of the case by means of the various screws in the slotted members, shown clearly in Figure G.17.

Other than the sprocket assembly, which has been previously discussed, further adjustments are straightforward but rarely required unless the bonus feature has been completely disassembled.

Maintenance and Lubrication of the Bonus Feature

Lubrication of the bonus feature itself depends upon the periodic maintenance which the machine's owner intends to devote to it. Light oiling is preferred if the machine will be serviced on a regular basis. But oil tends

to attract dust, oxidize and become gummy. If the machine's owner belongs to the "Lazy Lube Club," it would be better to thoroughly clean the light-working parts and give them *no* lubrication!

The Sprocket Assembly: The sprocket assembly, which is the nerve center for proper operation of the BONUS slot machine, *must* be kept clean and must work freely at all times. Periodic maintenance should include cleaning with lacquer thinner or lighter fluid, followed by blowing dry. If the assembly then works freely, it may be lightly oiled. A very small amount (a drop) of very light machine oil (such as Marvel Mystery Oil) should be placed on the mating surfaces.

The Index Cams and Shaft: The index cam shaft bearings and the top surfaces of the cams themselves should be periodically cleaned and lubricated with a medium weight (gun or sewing machine oil—Hoppes Gun Oil is excellent) machine oil. The bottom portion of the signals which touches the cams should also be wiped clean and lubricated with the same medium-weight machine oil. A Q-Tip is a convenient means of applying a thin oil film without causing dripping (on the reels!).

The area just below the right-hand end of the index shaft contains several additional mating and sliding parts which should be periodically lubricated with a small amount of medium weight machine oil from time to time.

The Bonus Payout Lever: The upper end of the bonus payout lever, where it contacts the two bonus payout cams (see Figure G.17), should be cleaned periodically and lightly lubricated with a medium weight machine oil.

The lower pivot point of the bonus payout lever should be lubricated with a heavy machine oil.

The Main Operating Link: The upper end of the main operating link, shown by Arrow A in Figure G.5, requires cleaning and lubrication with a heavy machine oil from time to time. The mating cam surfaces on the lower end should be lubricated with a very heavy machine oil or a very light grease.

Additional Information About the BONUS Family

The August 1980 issue of *Loose Change* magazine contains an article analyzing the complete statistics of the Mills BONUS bell slot machine.

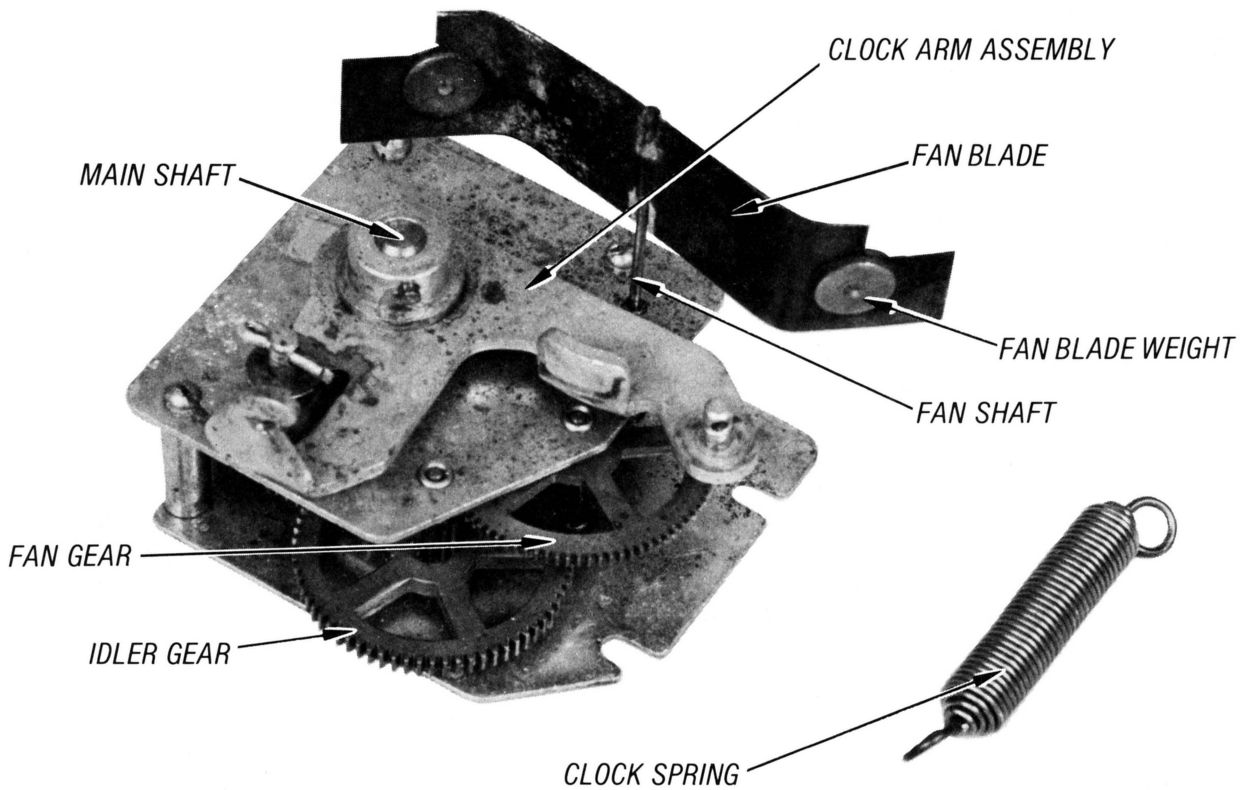
The January 1991 issue of *Loose Change* contains an article supplying additional historical information on the development of the BONUS family of machines. The incorporation of the Mills FUTURITY bell mechanism into the first model "Horse Head" BONUS is also covered.

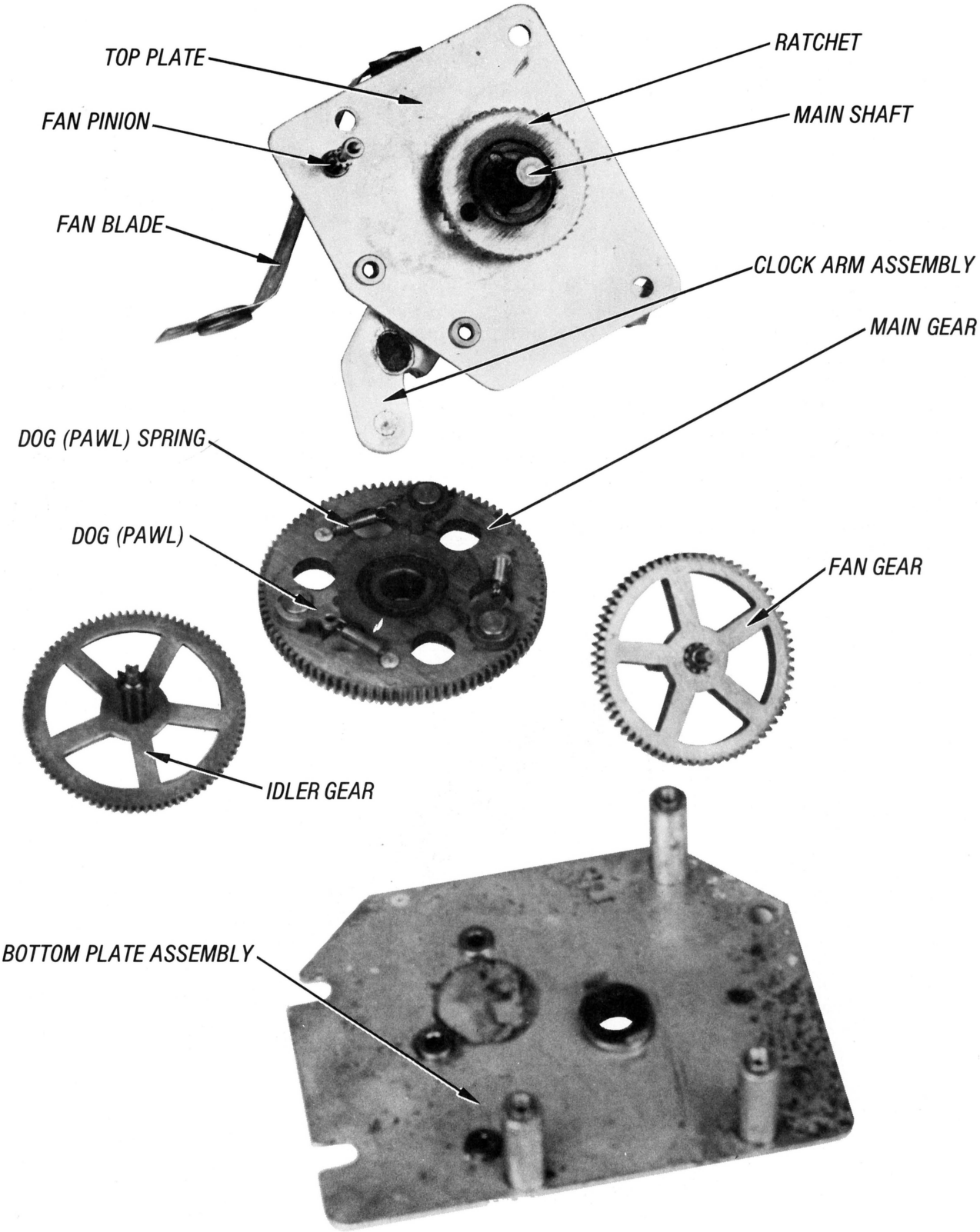
GLOSSARY

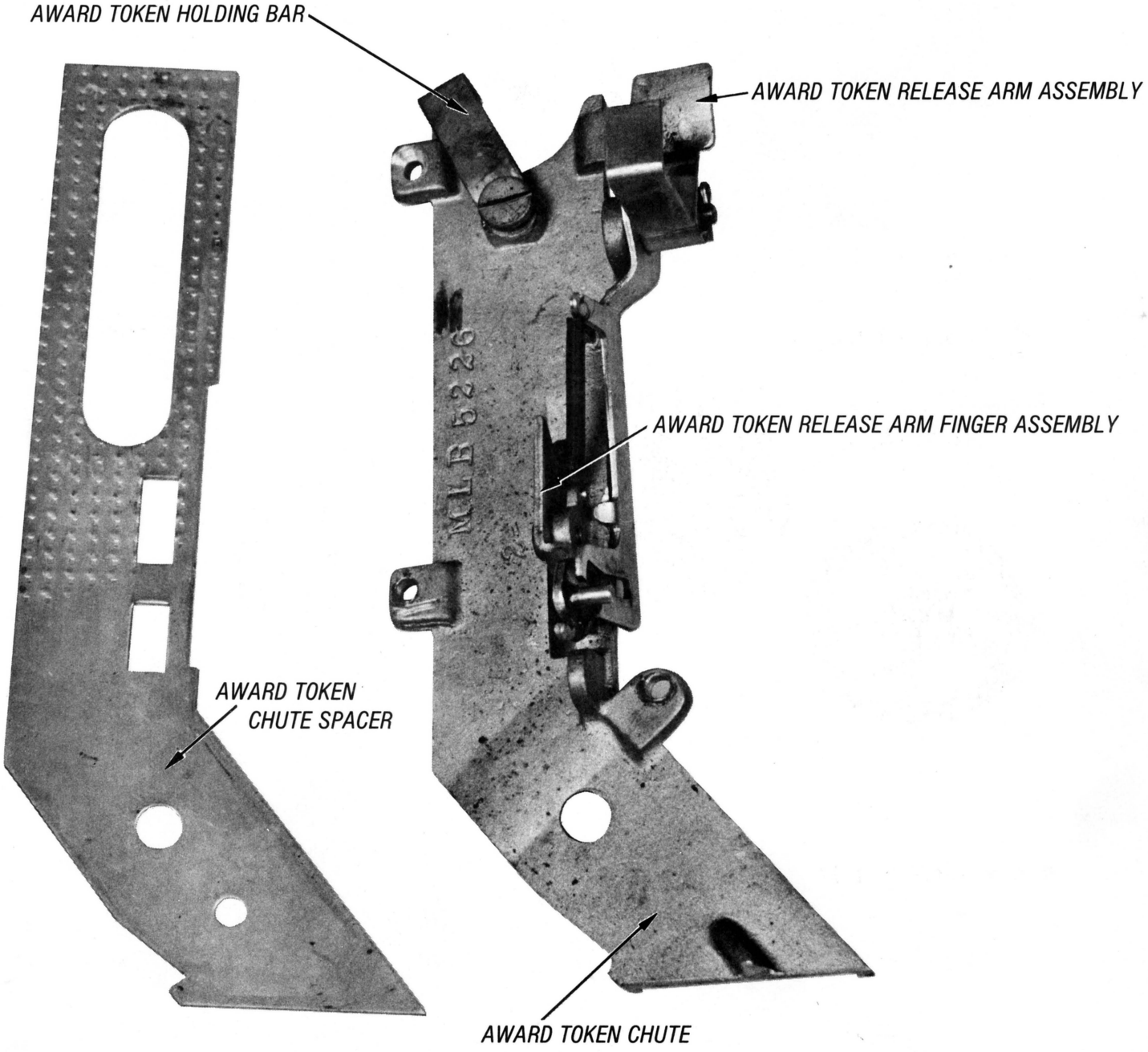
Pictorial Glossary

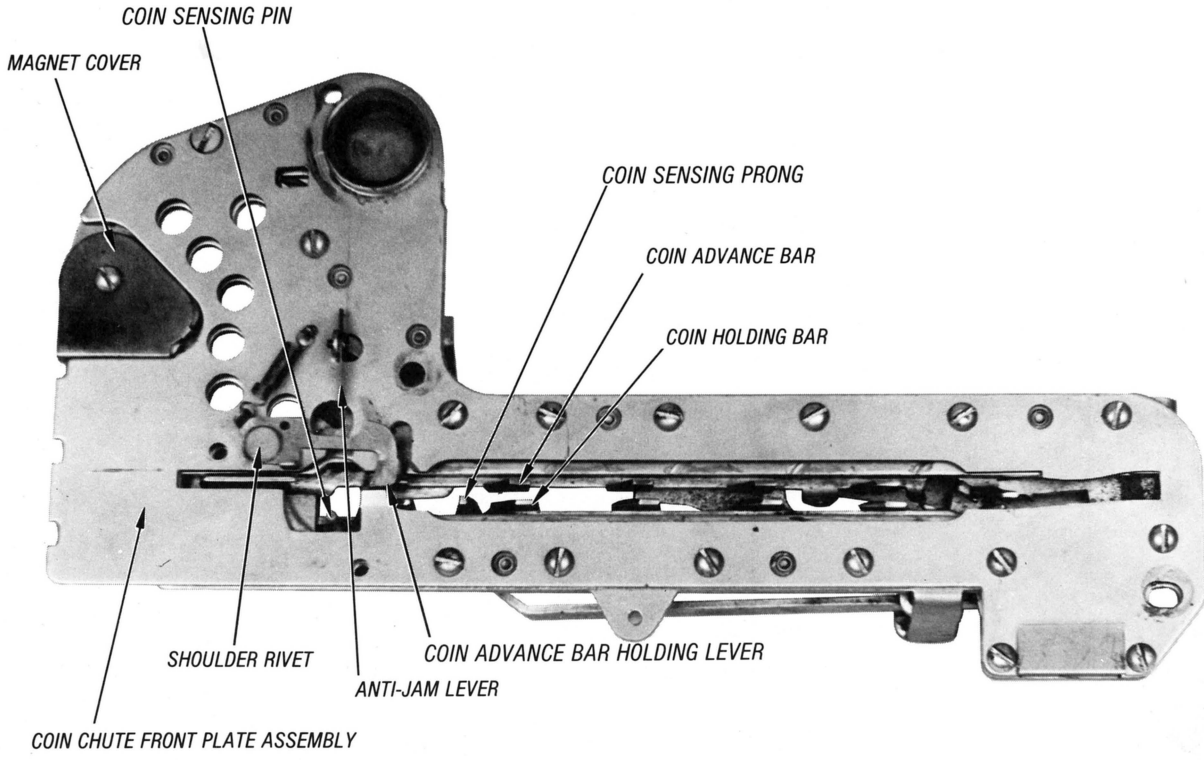
This pictorial glossary has been provided for rapid identification of every major working part of the mechanism, escalator, jackpot, award token dispenser and case hardware. In order to prevent clutter, such parts as rollers, studs, cotter pins, shafts, bushings, springs, washers and most similar parts have not been specifically identified. These parts can easily be given their obvious names (i.e., lower payout lever spring).

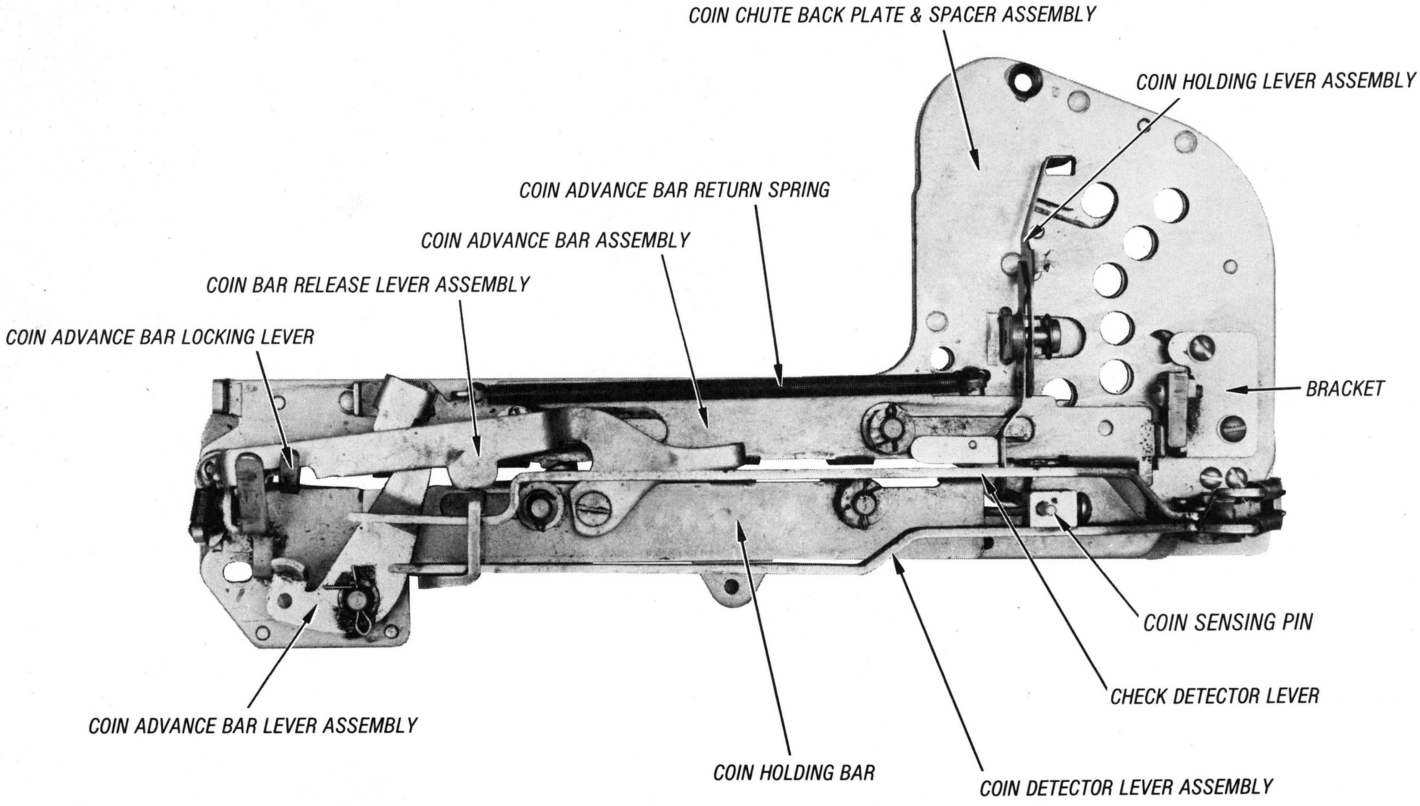
The nomenclature used in this glossary (and the entire book) is completely consistent with the nomenclature provided by other manufacturers in their descriptions of their machines and various parts; it is also consistent with other books in the *Owner's Pictorial Guide* series. In a few cases more appropriate names have been assigned (i.e., jackpot loading wire has been replaced by operating lever stop release wire), since the basic function of some of the parts originally were assigned misleading or meaningless names. In all cases where mistakes occured in original literature, the proper names have been assigned. It will be to the owner's advantage to avoid using slang names for the various parts; correct terminology can be understood by everyone familiar with slot machines.

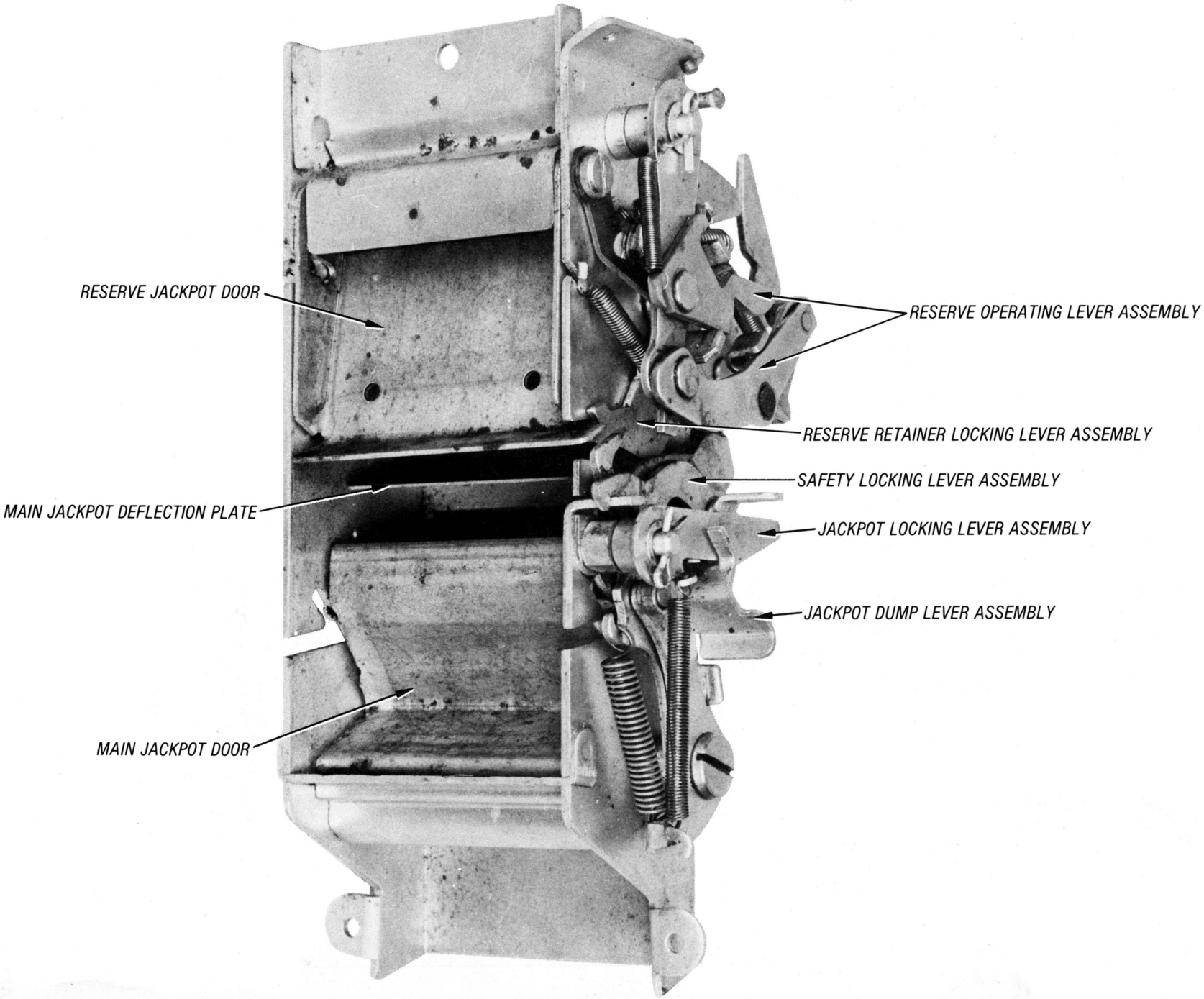


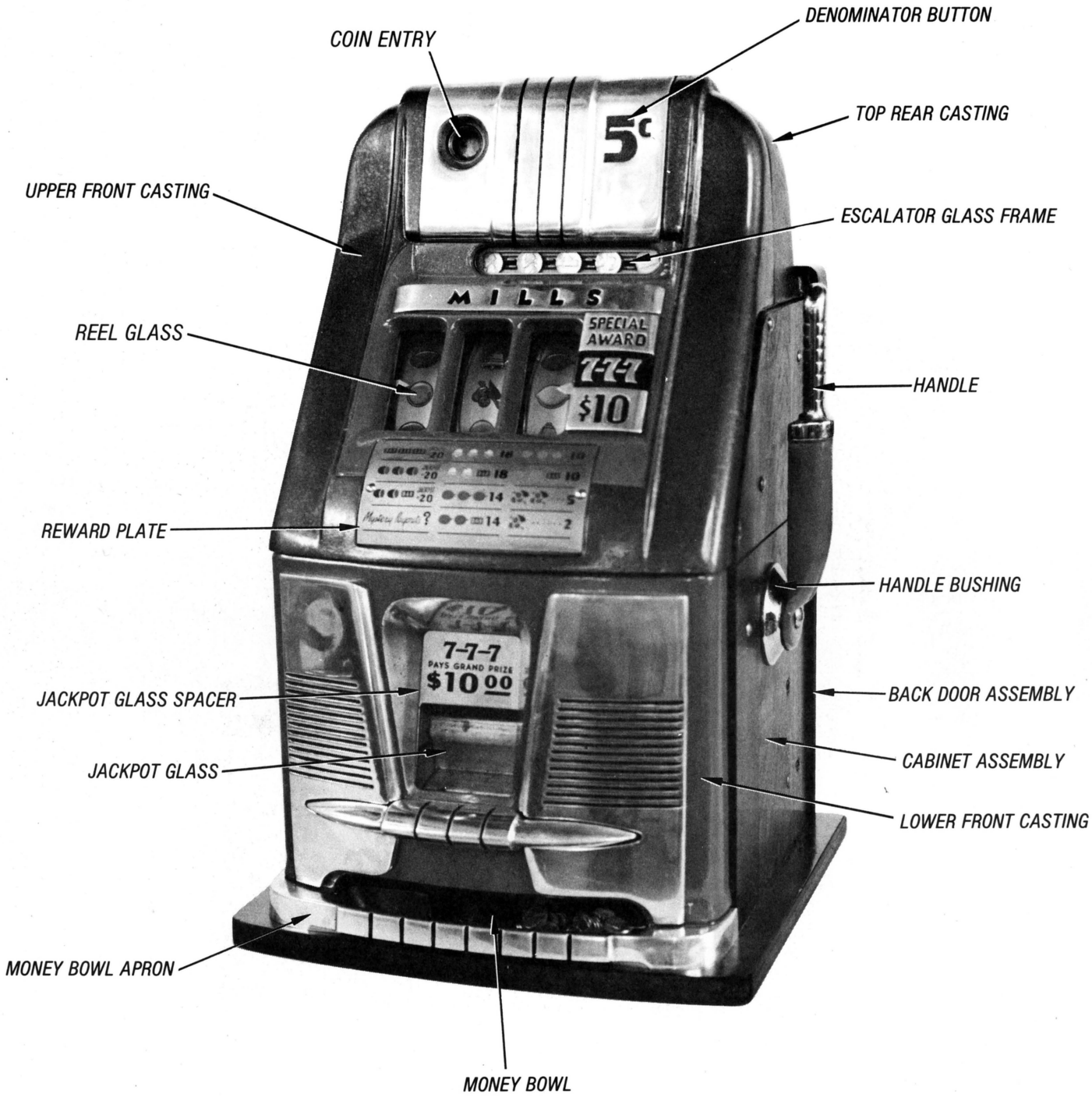

TOP PLATE
RATCHET
FAN PINION
MAIN SHAFT
FAN BLADE
CLOCK ARM ASSEMBLY
MAIN GEAR
DOG (PAWL) SPRING
DOG (PAWL)
FAN GEAR
IDLER GEAR
BOTTOM PLATE ASSEMBLY

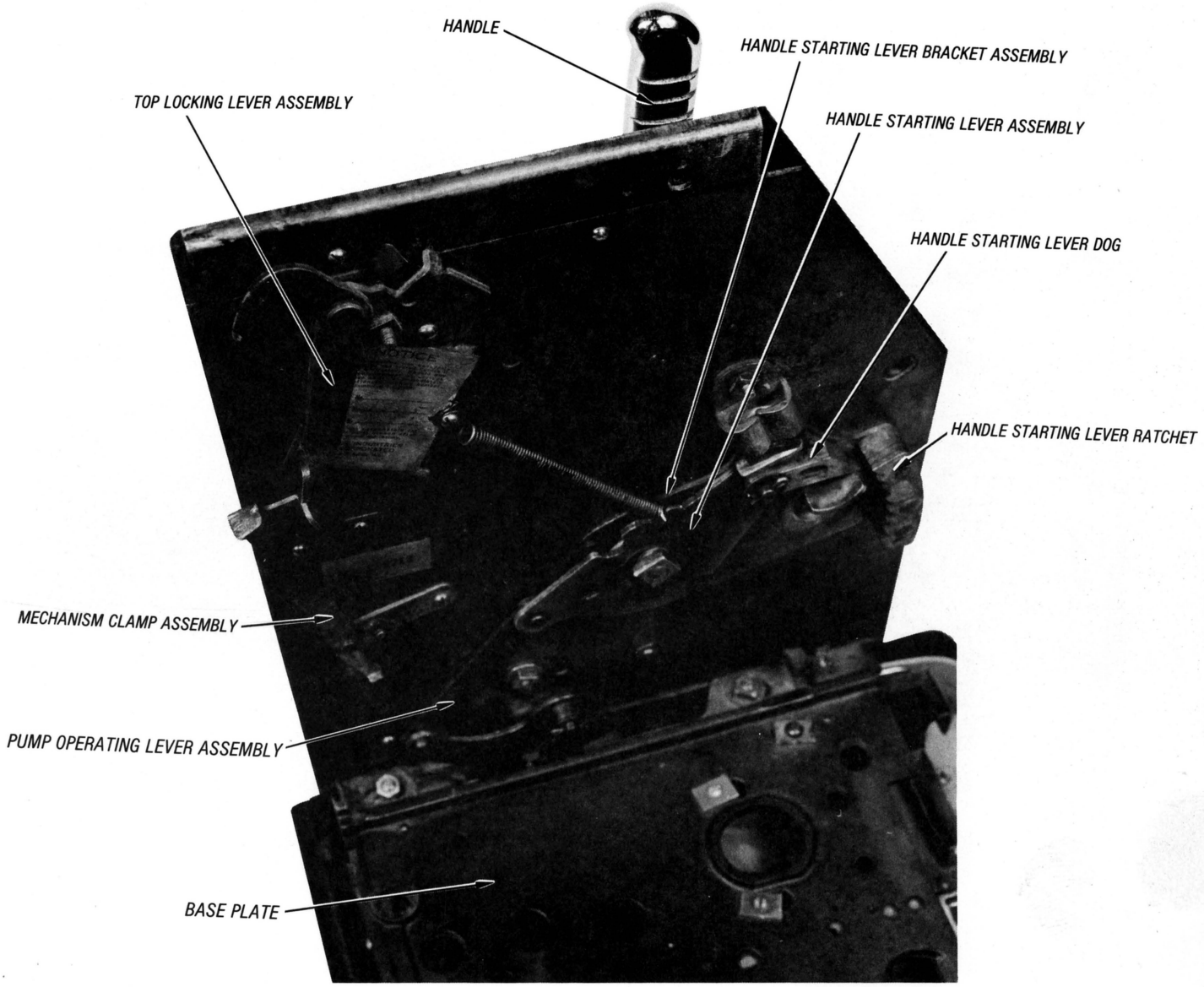

AWARD TOKEN HOLDING BAR
AWARD TOKEN RELEASE ARM ASSEMBLY
AWARD TOKEN RELEASE ARM FINGER ASSEMBLY
AWARD TOKEN CHUTE SPACER
AWARD TOKEN CHUTE
MLR 5226

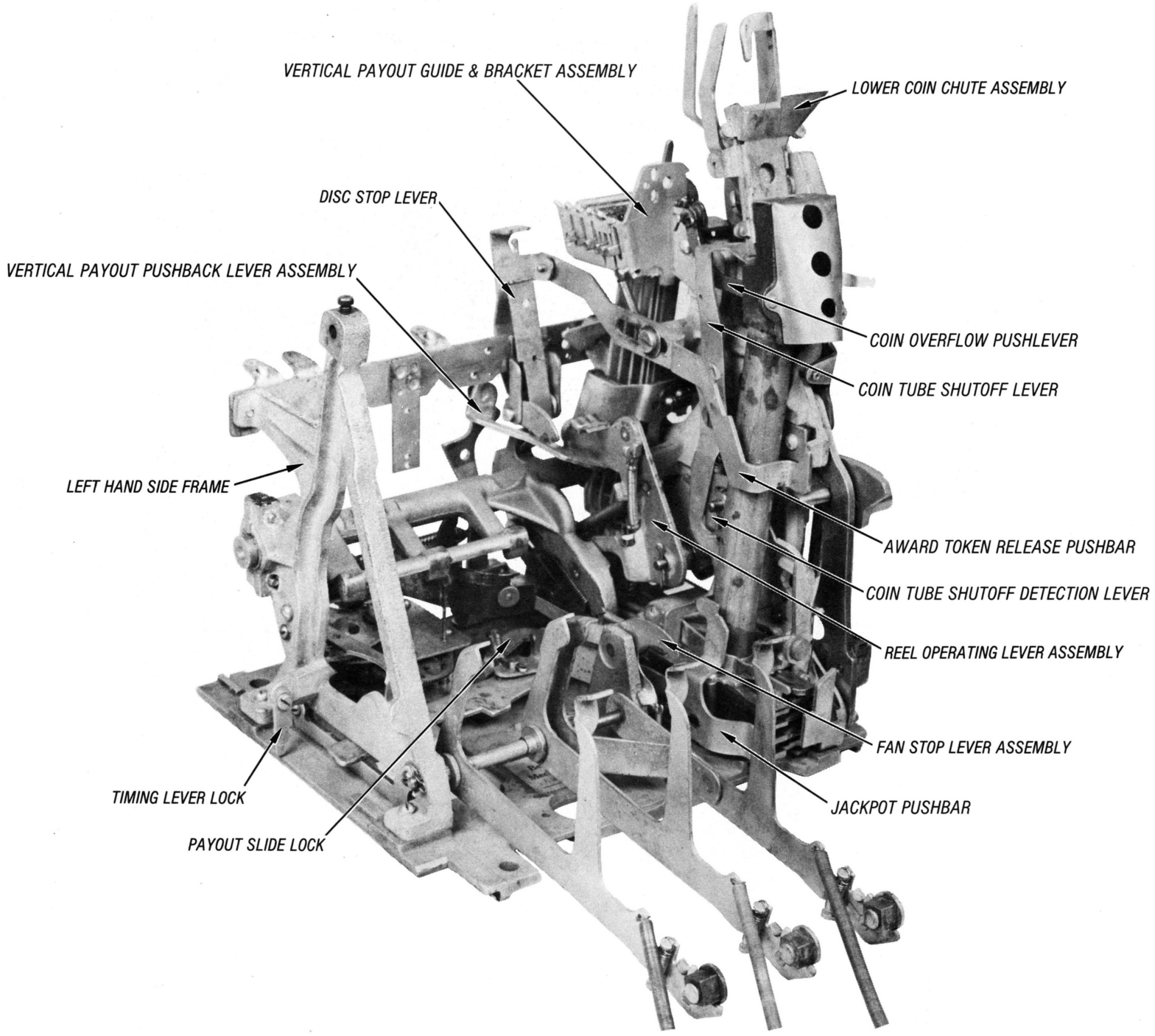

COIN SENSING PIN
MAGNET COVER
COIN SENSING PRONG
COIN ADVANCE BAR
COIN HOLDING BAR
SHOULDER RIVET
ANTI-JAM LEVER
COIN ADVANCE BAR HOLDING LEVER
COIN CHUTE FRONT PLATE ASSEMBLY

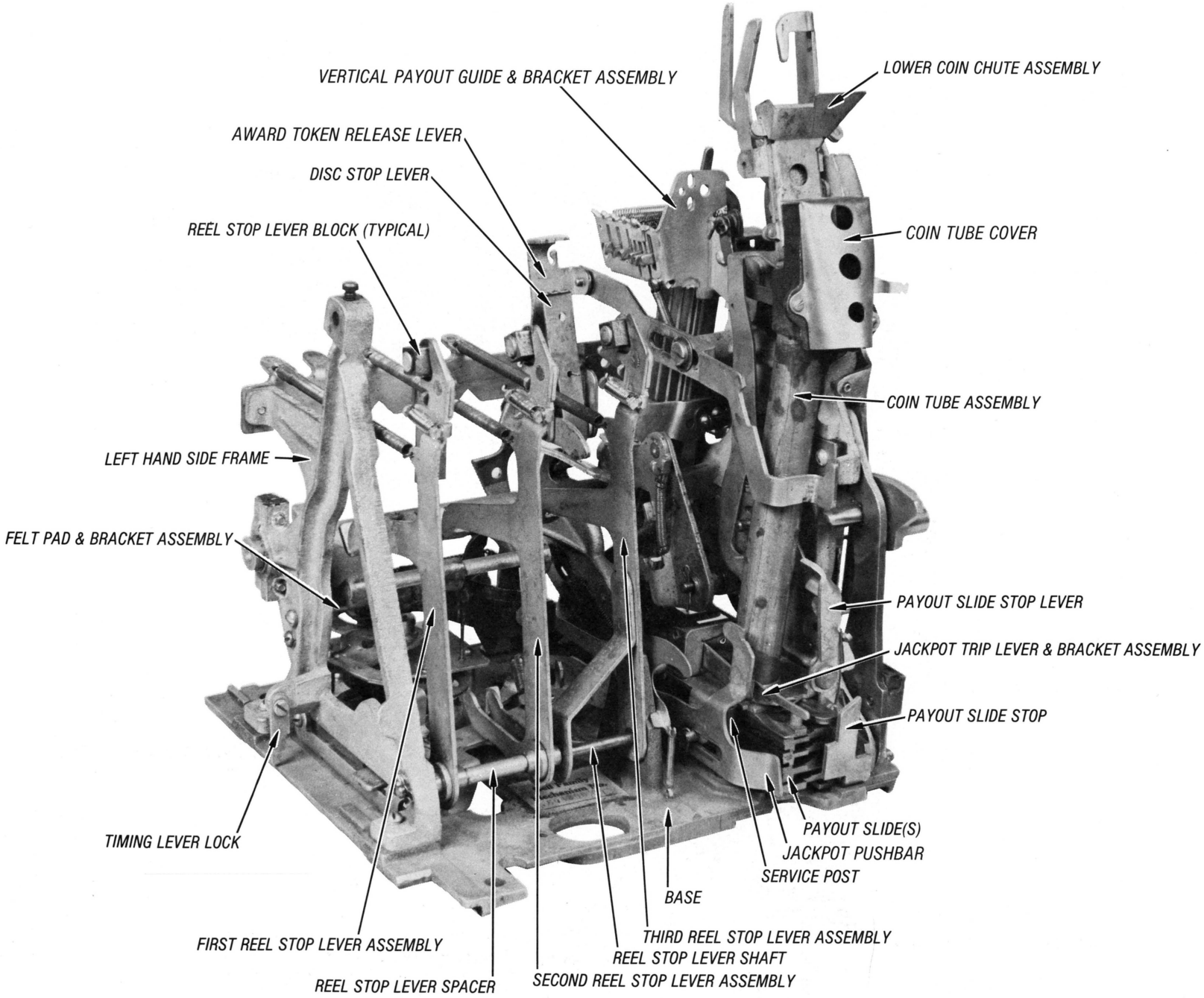

COIN CHUTE BACK PLATE & SPACER ASSEMBLY
COIN HOLDING LEVER ASSEMBLY
COIN ADVANCE BAR RETURN SPRING
COIN ADVANCE BAR ASSEMBLY
COIN BAR RELEASE LEVER ASSEMBLY
COIN ADVANCE BAR LOCKING LEVER
BRACKET
COIN SENSING PIN
CHECK DETECTOR LEVER
COIN ADVANCE BAR LEVER ASSEMBLY
COIN HOLDING BAR
COIN DETECTOR LEVER ASSEMBLY

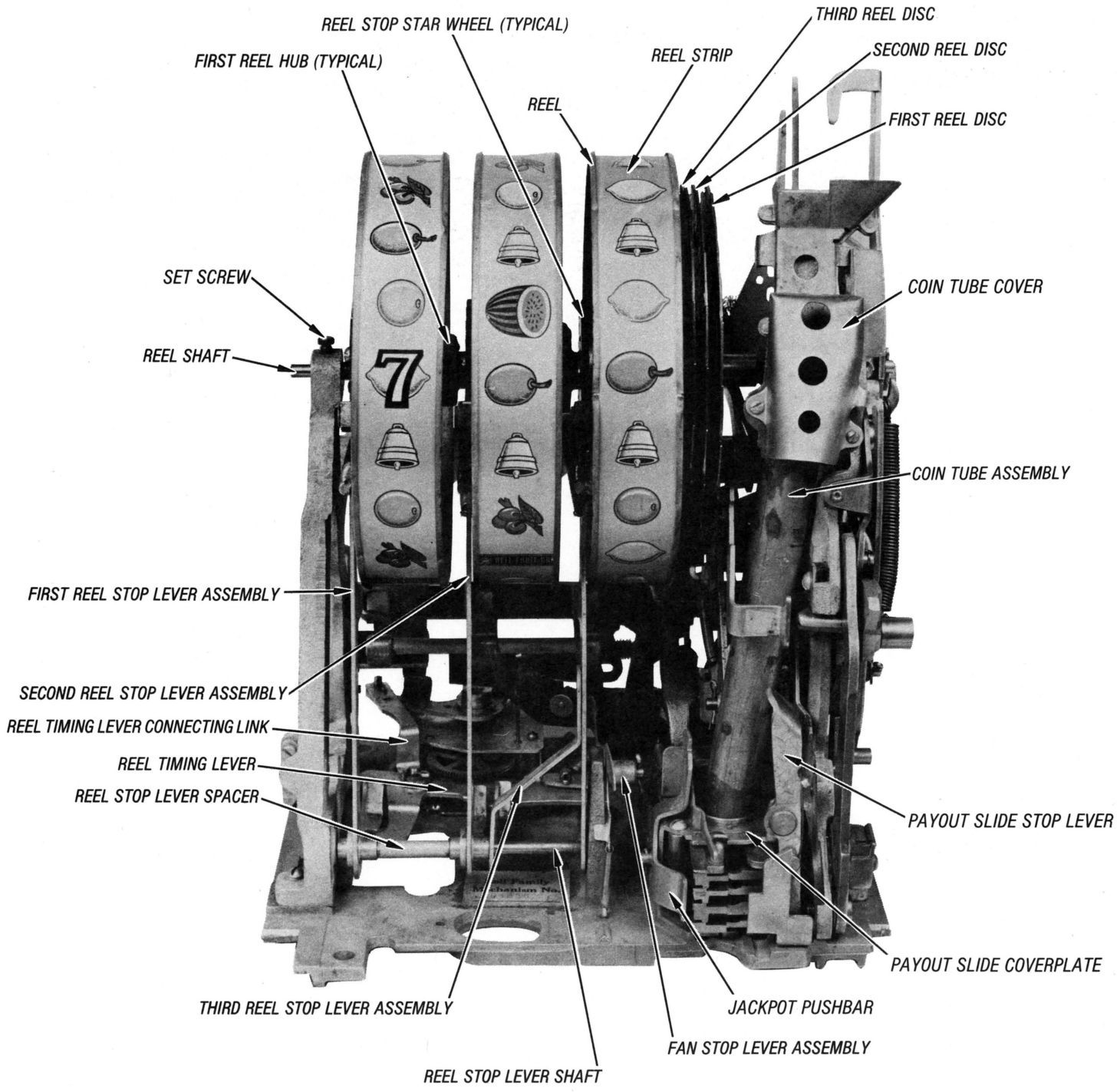

RESERVE JACKPOT DOOR
RESERVE OPERATING LEVER ASSEMBLY
RESERVE RETAINER LOCKING LEVER ASSEMBLY
SAFETY LOCKING LEVER ASSEMBLY
MAIN JACKPOT DEFLECTION PLATE
JACKPOT LOCKING LEVER ASSEMBLY
JACKPOT DUMP LEVER ASSEMBLY
MAIN JACKPOT DOOR

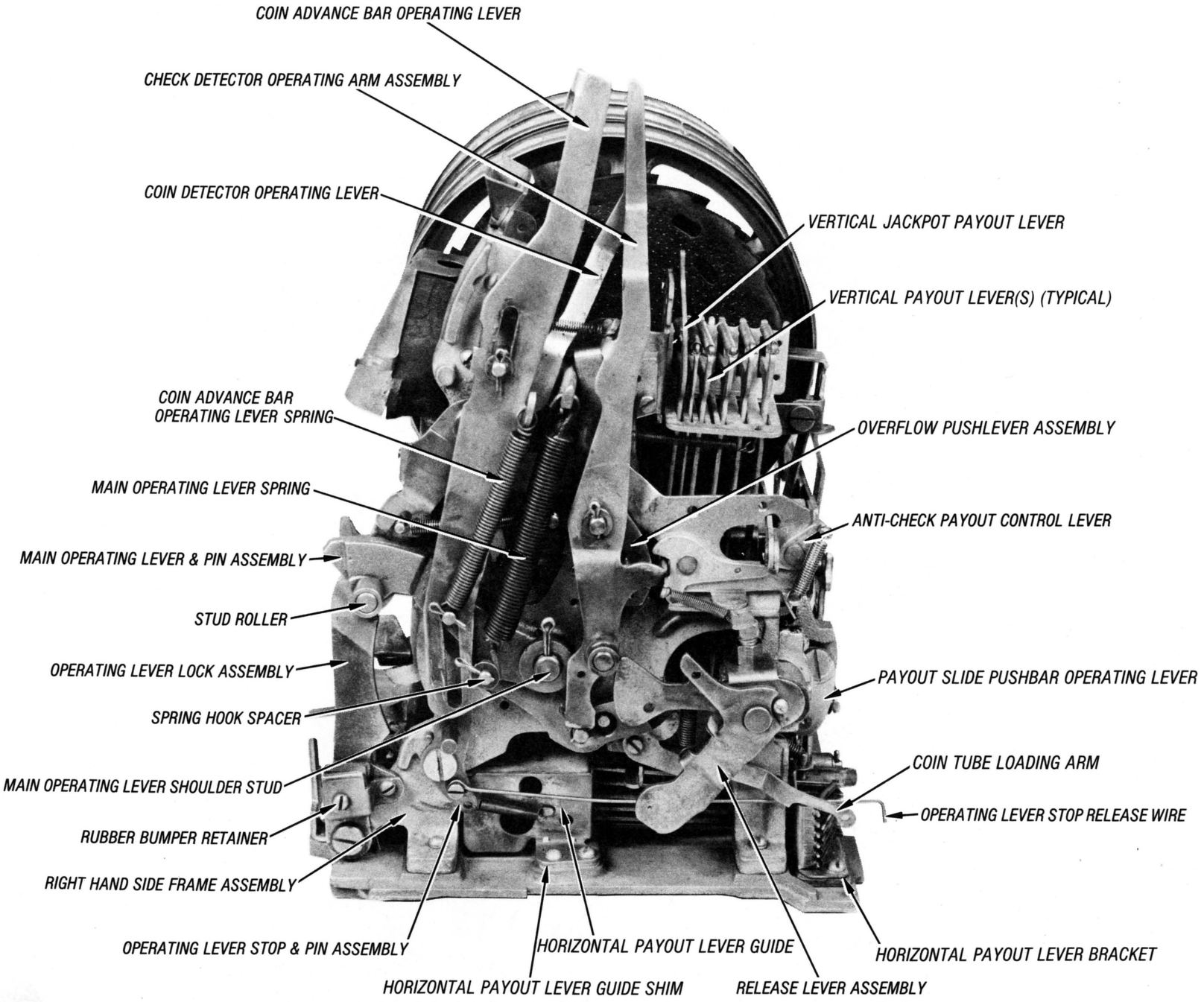

COIN ENTRY
DENOMINATOR BUTTON
TOP REAR CASTING
UPPER FRONT CASTING
ESCALATOR GLASS FRAME
REEL GLASS
HANDLE
REWARD PLATE
HANDLE BUSHING
JACKPOT GLASS SPACER
BACK DOOR ASSEMBLY
JACKPOT GLASS
CABINET ASSEMBLY
LOWER FRONT CASTING
MONEY BOWL APRON
MONEY BOWL
5¢
MILLS
SPECIAL AWARD
7-7-7
$10
7-7-7
PAYS GRAND PRIZE
$10 00

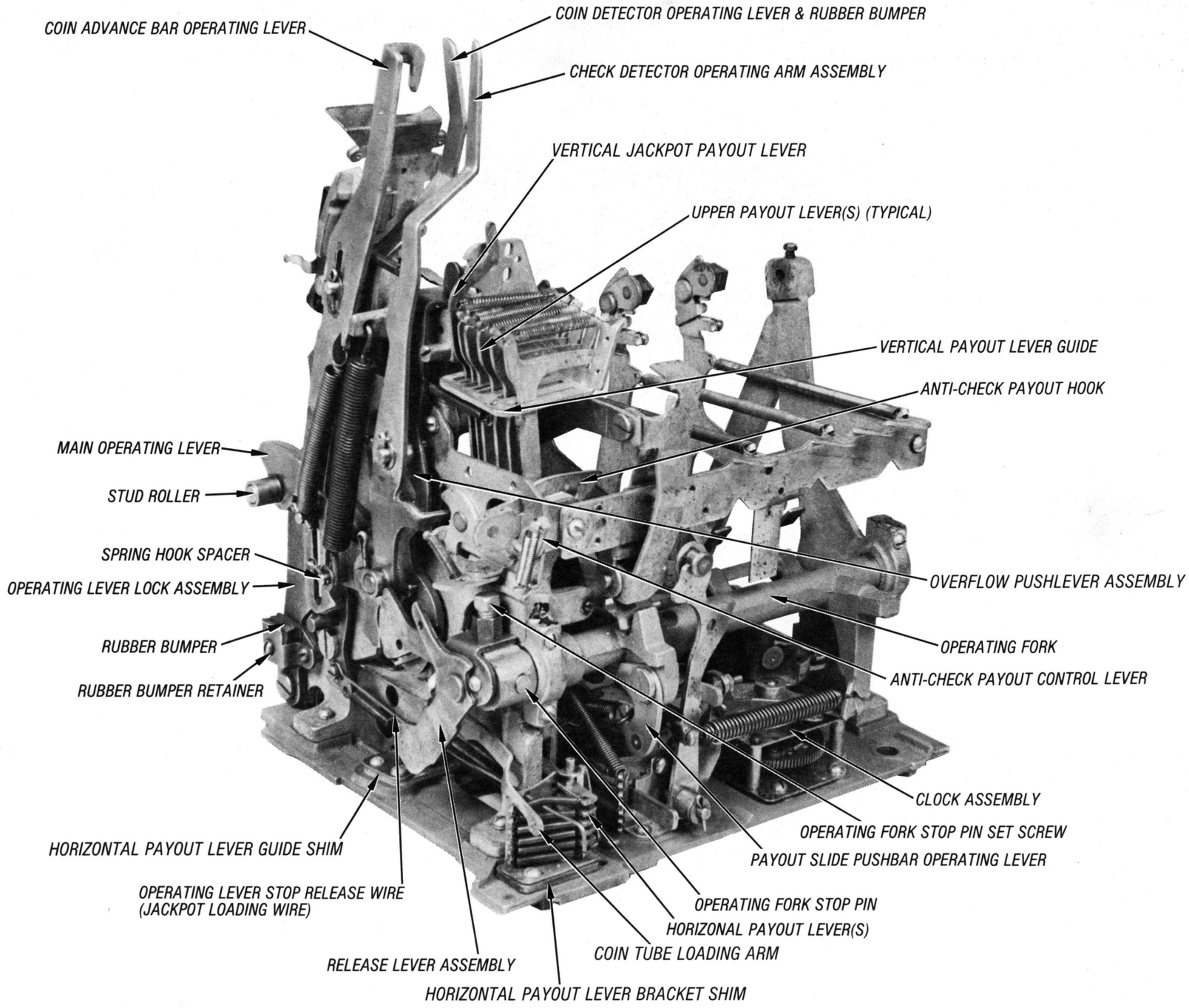

HANDLE
HANDLE STARTING LEVER BRACKET ASSEMBLY
TOP LOCKING LEVER ASSEMBLY
HANDLE STARTING LEVER ASSEMBLY
HANDLE STARTING LEVER DOG
HANDLE STARTING LEVER RATCHET
MECHANISM CLAMP ASSEMBLY
PUMP OPERATING LEVER ASSEMBLY
BASE PLATE

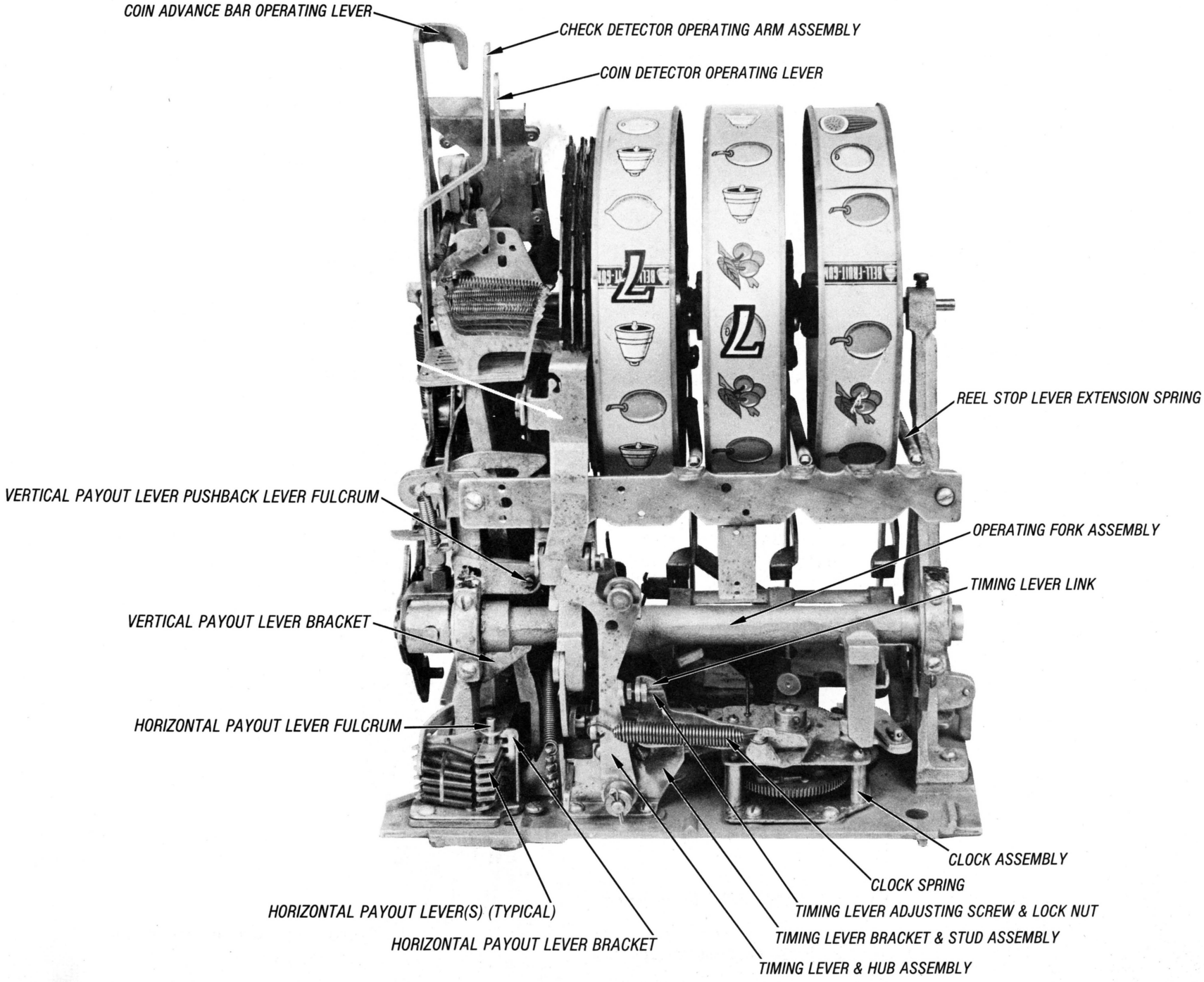

VERTICAL PAYOUT GUIDE & BRACKET ASSEMBLY
LOWER COIN CHUTE ASSEMBLY
DISC STOP LEVER
VERTICAL PAYOUT PUSHBACK LEVER ASSEMBLY
COIN OVERFLOW PUSHLEVER
COIN TUBE SHUTOFF LEVER
LEFT HAND SIDE FRAME
AWARD TOKEN RELEASE PUSHBAR
COIN TUBE SHUTOFF DETECTION LEVER
REEL OPERATING LEVER ASSEMBLY
FAN STOP LEVER ASSEMBLY
TIMING LEVER LOCK
JACKPOT PUSHBAR
PAYOUT SLIDE LOCK


VERTICAL PAYOUT GUIDE & BRACKET ASSEMBLY
LOWER COIN CHUTE ASSEMBLY
AWARD TOKEN RELEASE LEVER
DISC STOP LEVER
REEL STOP LEVER BLOCK (TYPICAL)
COIN TUBE COVER
COIN TUBE ASSEMBLY
LEFT HAND SIDE FRAME
FELT PAD & BRACKET ASSEMBLY
PAYOUT SLIDE STOP LEVER
JACKPOT TRIP LEVER & BRACKET ASSEMBLY
PAYOUT SLIDE STOP
TIMING LEVER LOCK
PAYOUT SLIDE(S)
JACKPOT PUSHBAR
SERVICE POST
BASE
FIRST REEL STOP LEVER ASSEMBLY
THIRD REEL STOP LEVER ASSEMBLY
REEL STOP LEVER SHAFT
REEL STOP LEVER SPACER
SECOND REEL STOP LEVER ASSEMBLY

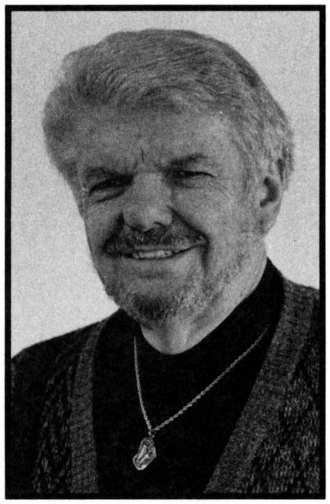

REEL STOP STAR WHEEL (TYPICAL)
THIRD REEL DISC
FIRST REEL HUB (TYPICAL)
REEL STRIP
SECOND REEL DISC
REEL
FIRST REEL DISC
SET SCREW
COIN TUBE COVER
REEL SHAFT
COIN TUBE ASSEMBLY
FIRST REEL STOP LEVER ASSEMBLY
SECOND REEL STOP LEVER ASSEMBLY
REEL TIMING LEVER CONNECTING LINK
REEL TIMING LEVER
REEL STOP LEVER SPACER
PAYOUT SLIDE STOP LEVER
PAYOUT SLIDE COVERPLATE
THIRD REEL STOP LEVER ASSEMBLY
JACKPOT PUSHBAR
FAN STOP LEVER ASSEMBLY
REEL STOP LEVER SHAFT


COIN ADVANCE BAR OPERATING LEVER
CHECK DETECTOR OPERATING ARM ASSEMBLY
COIN DETECTOR OPERATING LEVER
VERTICAL JACKPOT PAYOUT LEVER
VERTICAL PAYOUT LEVER(S) (TYPICAL)
COIN ADVANCE BAR OPERATING LEVER SPRING
OVERFLOW PUSHLEVER ASSEMBLY
MAIN OPERATING LEVER SPRING
ANTI-CHECK PAYOUT CONTROL LEVER
MAIN OPERATING LEVER & PIN ASSEMBLY
STUD ROLLER
OPERATING LEVER LOCK ASSEMBLY
PAYOUT SLIDE PUSHBAR OPERATING LEVER
SPRING HOOK SPACER
COIN TUBE LOADING ARM
MAIN OPERATING LEVER SHOULDER STUD
OPERATING LEVER STOP RELEASE WIRE
RUBBER BUMPER RETAINER
RIGHT HAND SIDE FRAME ASSEMBLY
OPERATING LEVER STOP & PIN ASSEMBLY
HORIZONTAL PAYOUT LEVER GUIDE
HORIZONTAL PAYOUT LEVER BRACKET
HORIZONTAL PAYOUT LEVER GUIDE SHIM
RELEASE LEVER ASSEMBLY


COIN ADVANCE BAR OPERATING LEVER
COIN DETECTOR OPERATING LEVER & RUBBER BUMPER
CHECK DETECTOR OPERATING ARM ASSEMBLY
VERTICAL JACKPOT PAYOUT LEVER
UPPER PAYOUT LEVER(S) (TYPICAL)
VERTICAL PAYOUT LEVER GUIDE
ANTI-CHECK PAYOUT HOOK
MAIN OPERATING LEVER
STUD ROLLER
SPRING HOOK SPACER
OPERATING LEVER LOCK ASSEMBLY
OVERFLOW PUSHLEVER ASSEMBLY
RUBBER BUMPER
RUBBER BUMPER RETAINER
OPERATING FORK
ANTI-CHECK PAYOUT CONTROL LEVER
CLOCK ASSEMBLY
OPERATING FORK STOP PIN SET SCREW
PAYOUT SLIDE PUSHBAR OPERATING LEVER
HORIZONTAL PAYOUT LEVER GUIDE SHIM
OPERATING LEVER STOP RELEASE WIRE (JACKPOT LOADING WIRE)
OPERATING FORK STOP PIN
HORIZONAL PAYOUT LEVER(S)
COIN TUBE LOADING ARM
RELEASE LEVER ASSEMBLY
HORIZONTAL PAYOUT LEVER BRACKET SHIM


COIN ADVANCE BAR OPERATING LEVER
CHECK DETECTOR OPERATING ARM ASSEMBLY
COIN DETECTOR OPERATING LEVER
REEL STOP LEVER EXTENSION SPRING
VERTICAL PAYOUT LEVER PUSHBACK LEVER FULCRUM
OPERATING FORK ASSEMBLY
TIMING LEVER LINK
VERTICAL PAYOUT LEVER BRACKET
HORIZONTAL PAYOUT LEVER FULCRUM
CLOCK ASSEMBLY
CLOCK SPRING
HORIZONTAL PAYOUT LEVER(S) (TYPICAL)
TIMING LEVER ADJUSTING SCREW & LOCK NUT
HORIZONTAL PAYOUT LEVER BRACKET
TIMING LEVER BRACKET & STUD ASSEMBLY
TIMING LEVER & HUB ASSEMBLY

THE AUTHORS



Robert N. Geddes

Robert N. Geddes is no stranger to the world of slot machines. He has written over 40 articles on a variety of gambling devices and related topics. He has also authored four comprehensive technical manuals covering various slot machines. Additionally, he provided the humorous and informative text for the widely-acclaimed and ever-popular art book, *Slot Machines on Parade*. In addition to the books and many articles he has written, he has also been an avid collector and restorer of a a vast array of slot machines for the past 18 years. This background has provided hem with practical, hands-on experience which he has been able to successfully communicate to other hobbyists and collectors.

Bob is a man with a broad background of talents and interests. As a graduate of both Stanford University and the University of Southern California, he has graduate degrees in electrical engineering and mathematics. After a five-year tenure as a professor at the University of Southern California, he accepted a position at The Aerospace Corporation as a technical consultant and program director for the United States Air Force Satellite Systems Division.

After developing several large scale real estate projects in the Los Angeles area with friends and associates, Bob moved to San Diego where he became involved in the antique import business and the manufacturing and marketing of various antique product lines. It was in San Diego that he finally found time to begin writing about his one continuing hobby—the collection of slot machines and antique gambling devices.

Bob eventually moved to Las Vegas, Nevada—a state where the possession of all slot machines is legal. With his penchant for writing definitive books on slot machines and gambling, Las Vegas provides Bob with daily access to information about gambling devices and games of chance.

Besides his writing activities, Bob also serves as a consultant to various gaming equipment manufacturers and casinos.

Daniel R. Mead

Ever since childhood, Daniel R, Mead has been fascinated with slot machines. Barely out of his teens, he designed and built a primitive, but working, slot machine. Dan then worked as a slot machine mechanic at the Horseshoe Club in Reno while attending the University of Nevada. During college, he also designed and developed a commercial slot machine for Nevada Air Products.

Dan graduated from the University of Nevada with a degree in mechanical engineering, and during his engineering career he became licensed as a professional engineer in California. By the mid-1960s he had left his engineering career in order to pursue another life-long interest—printing—which had been a hobby since childhood.

In August of 1977, nearly a year after California legalized the ownership of antique slot machines, Dan recognized the need for a formal publication for people interested in slot machines. He carefully planned the format of the publication, and after discarding dozens of names, chose the name of *Loose Change*. The acceptance of *Loose Change* proved

to be enormous, and Dan's commercial printing business, for the most part, no longer exists. Mead Publishing Company now specializes in the publication of books devoted to enthusiasts of coin-operated machines and related items.

Soon after the introduction of *Loose Change* magazine, Dan recognized the need to expand the recognition of antique slot machines as collectibles; he organized and helped produce the first national slot machine collectors' show and sale . . . the Loose Change Fun Fair.

When pending legislation threatened to destroy the collecting of antique slot machines in California during the mid-1980s, Dan organized the Antique Coin Machine Collectors Association (ACMCA). He was elected to be the first president of the organization where he spearheaded the defeat of the unfavorable legislation.

Dan's publishing business has been uniquely devoted to the full-time research of gaming machine nostalgia. In his quest for the unusual in gaming machine stories, he has traveled the nation and other parts of the world where gaming is legal. In 1987, Dan decided he needed daily access to the gaming capitol of the world; he moved his entire business and printing plant from Los Angeles to Las Vegas.

Dan is also an accomplished photographer. This propensity—another life-long hobby—has served him well in illustrating articles and books he has published. Indeed, his most famous pictures are showcased in his most elaborate book, *Slot Machines on Parade.*

Dan has written hundreds of articles about slot machines, gaming memorabilia and related topics. Additionally, Dan has also been a guest writer for *Gambling Times* magazine and the *Las Vegas Review Journal.*

Other Books From Mead Publishing Company

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Slot Machines On Parade
Owner's Pictorial Guide: Bally Electromechanical Slot Machines
Owner's Pictorial Guide: Jennings Bell Slot Machine
Owner's Pictorial Guide: Pace Bell Slot Machine
Owner's Pictorial Guide: Watling Bell Slot Machine
Blue Book Slot Machine Price Guide
Collector's Treasury of Antique Slot Machines
Mills of the Thirties Operator's Companion
Mills of the Forties Operator's Companion
Watling Operator's Companion
Anatomy of a Vintage Slot Machine
Bell Machine Parts and Service Manual
Mills Parts List and Supplement Service Manual
Kernan Manufacturing Company Catalog
Pace Parts List and Service Manual
Caille Brothers Company – Catalog 311
Caille Amusement Machines – Catalog 512
Vest Pocket Bell Instructions and Part Numbers
Handbook of Slot Machine Reel Strips
Amusement Tokens of the United States and Canada
Gumball Machines – Right or Wrong
Bally M/742 Instructions and Parts List, 115 Volts
Bally M/742A Instructions and Parts List, 50 Volts

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To Be Published in the Near Future

The Mills Legacy – The Story of the Mills Novelty Company
The Great Big Picture Book of Slot Machines
The Encyclopedia of Slot Machines
Law Enforcement Officer's Guide To Gambling Devices
The Pinball Encyclopedia – Games of the Twentieth Century
Red Book Trade Stimulator and Counter Game Price Guide

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Loose Change Magazine

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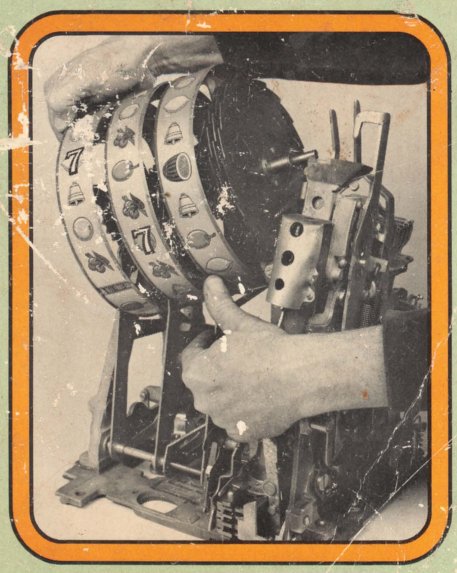
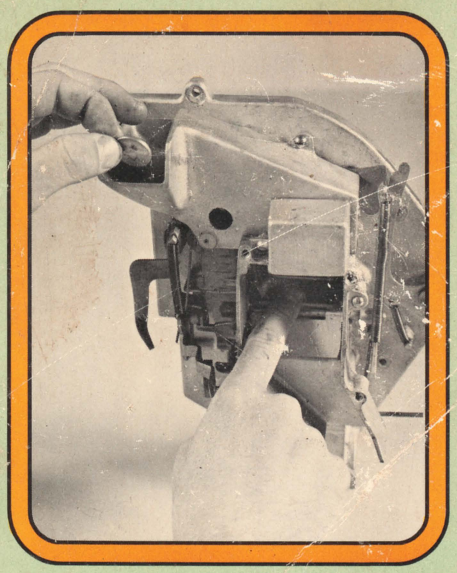
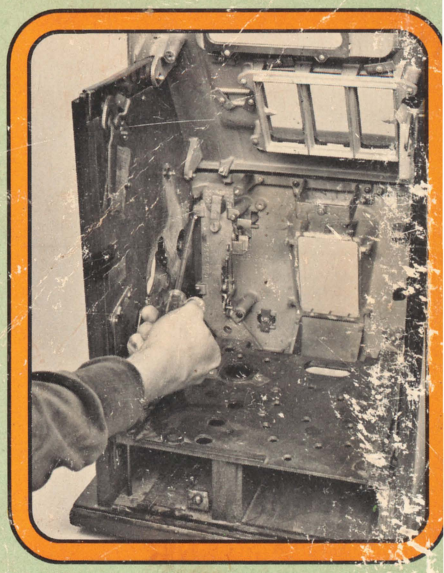
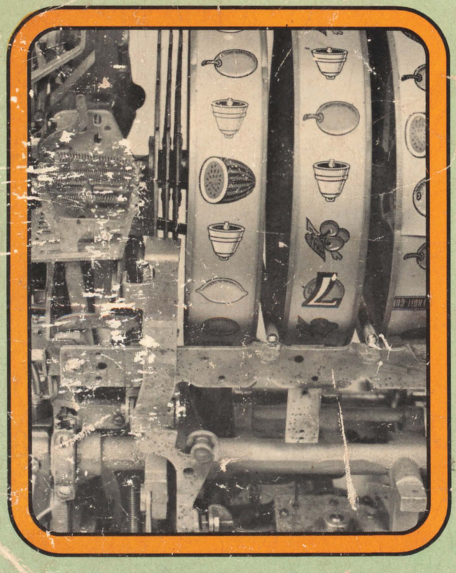
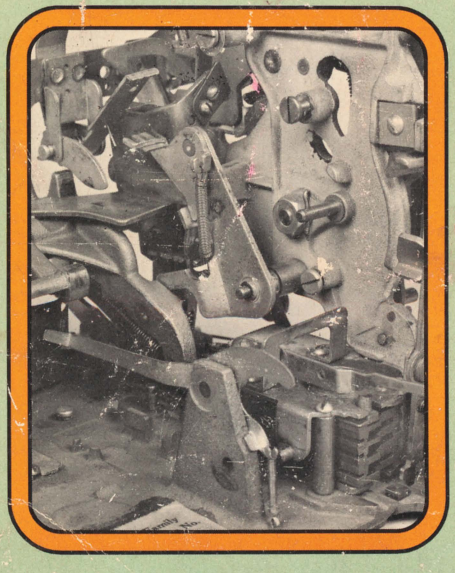
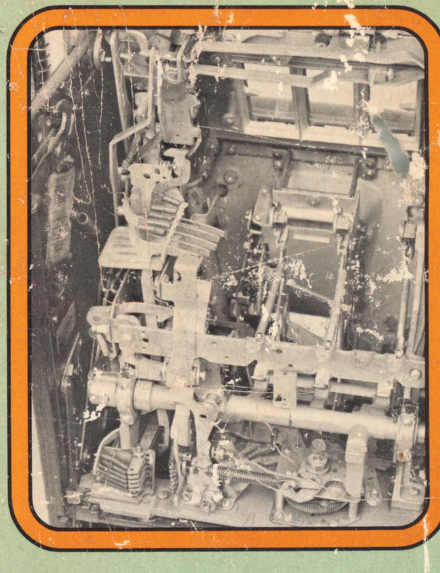
MEAD PUBLISHING COMPANY
1515 SOUTH COMMERCE STREET
LAS VEGAS, NEVADA 89102-2703







Do you know . . .

- how to clear any coin jam in less than two minutes?
- how to set the time for a complete play cycle of the machine?
- the quickest way to empty coins out of the machine?
- the quickest way to fill the machine and jackpots with coins?
- how to convert winning combinations to check payout?
- how to create a jackpot payout without touching the reels?
- the first thing to look for when the machine won't pay off on a winner?
- how to determine the odds of the machine?
- the simplest way to change the odds of the machine?
- how to diagnose problems by using only your ears?
- the easiest way to observe and repair faulty jackpot operation?
- how to free play the machine in the cabinet?
- how to lubricate almost all moving parts by loosening one screw?

If the answer to any of these questions can benefit your collecting and working with the Mills bell slot machine, then this book is an absolute must! All of these maintenance tricks as well as thousands more, are revealed inside this illustrated and easy-to-use manual. This third edition speaks for itself as an ongoing friend to the Mills bell slot machine owner.